ANNALS

OF

The Entomological Society of America

VOLUME XVIII, 1925

EDITORIAL BOARD

HERBERT OSBORN, Managing Editor,
COLUMBUS, OHIO.

CLARENCE H. KENNEDY, Ass't Managing Editor,
COLUMBUS, OHIO.

R. W. HARNED,
AGRICULTURAL COLLEGE, MISS.

G. C. CRAMPTON,
AMHERST, MASS.

R. A. COOLEY,
BOZEMAN, MONT.

WM. SCHAUS,
WASHINGTON, D. C

E. C. VANDYKE,
BERKELEY, CALIF.

W. E. BRITTON,
NEW HAVEN, CONN.

ARTHUR GIBSON,
OTTAWA, CANADA.

EDITH M. PATCH,
ORONO, MAINE.

W. A. RILEY,
ST. PAUL, MINN.

PUBLISHED QUARTERLY BY THE SOCIETY
COLUMBUS, OHIO

OFFICERS OF THE ENTOMOLOGICAL SOCIETY OF AMERICA.

Presidents.

J. H. Comstock	1906–7	Lawrence Bruner	1917
Wm. Wheeler	1908	Nathan Banks	1918
Henry Skinner	1909	J. G. Needham	1919
J. B. Smith	1910	L. O. Howard	1920
Herbert Osborn	1911	J. M. Aldrich	1921
S. A. Forbes	1912	Arthur Gibson	1922
C. J. S. Bethune	1913	T. D. A. Cockerell	1923
P. P. Calvert	1914	C. W. Johnson	1924
V. L. Kellogg	1915	Geo. A. Dean	1925
F. M. Webster	1916		

First Vice-Presidents.

James Fletcher	1907	E. M. Walker	1917
J. B. Smith	1908	T. D. A. Cockerell	1918
Herbert Osborn	1909	James W. Folsom	1919
S. A. Forbes	1910	F. E. Lutz	1920
Lawrence Bruner	1911	Arthur Gibson	1921
A. D. Hopkins	1912	W. A. Riley	1922
P. P. Calvert	1913	Wm. S. Marshall	1923
James G. Needham	1914	W. E. Britton	1924
J. S. Hine	1915	Lawson Caesar	1925
E. P. Felt	1916		

Second Vice-Presidents.

Henry Skinner	1907	H. C. Fall	1917
C. J. S. Bethune	1908	E. P. Van Duzee	1918
A. D. Hopkins	1909	R. V. Chamberlin	1919
V. L. Kellogg	1910	Edith M. Patch	1920
A. D. MacGillivray	1911	E. C. Van Dyke	1921
A. D. Hopkins	1912	R. A. Cooley	1922
P. P. Calvert	1913	F. E. Lutz	1923
James G. Needham	1914	C. T. Brues	1924
J. M. Aldrich	1915	Paul S. Welch	1925
A. L. Melander	1916		

Secretary-Treasurer.

J. Chester Bradley	1906–9	J. M. Aldrich	1916–20
C. R. Crosby	1910	C. L. Metcalf	1921–
A. D. MacGillivray	1911–15		

Managing Editor.

Herbert Osborn 1908–

595.7
A512A
V.18
Biology Dept. Library

CONTENTS OF VOLUME XVIII.

HOWARD, L. O.—The Needs of the World as to Entomology..... 1
List of Members of the Entomological Society of America..... v
FORBES, WM. T. M.—The Hypothetical Wing of the Hymenoptera..... 22
HINTZE, ANNA LAURA—The Behavior of the Larvae of Cotinis Nitida Burmeister (Coleoptera)..... 31
WEHRLE, LAWRENCE PAUL, and WELCH, PAUL S.—The Occurrence of Mites in the Tracheal System of Certain Orthoptera..... 35
WIEBE, A. H.—Artificial Fertilization of Aquatic Insects..... 45
CRAMPTON, G. C.—A Phylogenetic Study of the Thoracic Sclerites of the Non-Tipuloid Nematocerous Diptera..... 49
LINDSEY, A. W.—The Types of Hesperioid Genera..... 75
ALDRICH, J. M.—Notes on Some Types of American Muscoid Diptera in the Collection of the Vienna Natural History Museum.....107
Proceedings of the Washington Meeting.....131
GENIEYS, PAUL—Habrobracon brevicornis Wesm.....143
GILMER, PAUL M.—A Comparative Study of the Poison Apparatus of Certain Lepidopterous Larvae.....203
AUTEN, MARY—Insects Associated with Spider Nests.....240
GOOD, HENRY G.—Wing Venation of Buprestidae.....251
HULL, FRANK M.—Notes on the North American Species of the Genus Didea with the Description of a New Species.....277
BRAUER, ALFRED—Studies on the Embryology of Bruchus Quadrimaculatus Fabr.....283
PETRUNKEVITCH, ALEXANDER—Descriptions of New or Inadequately Known American Spiders.....313
BALL, E. D., AND DELONG, D. M.—The Genus Dikraneura and Its Allies in North America.....324
ALEXANDER, CHARLES P.—Studies on the Crane-flies of Mexico.....341
FULTON, B. B.—Physiological Variation in the Snowy Tree-Cricket, Oecanthus Niveus De Geer.....363
PARKER, H. L., AND THOMPSON, W. R.—Notes on the Larvae of the Chalcidoidea.....384
FROST, S. W.—The Leaf-Mining Habit in the Hymenoptera.....399
HUNGERFORD, H. B.—A New Notonecta from China.....417
BARBER, GEO. W.—Observations on the Response of Adults of the European Corn Borer to Light in Egg Laying.....419
TEAGUE, MILTON M.—A Review of the Genus Aclerda (Hemiptera:Coccidoidea) 432
LIU, CHUNG LO—Observations on the Acroglossal Buttons and on the Submentum of Hymenoptera.....445
ALDRICH, J. M.—Notes on Some Types of American Muscoid Diptera in the Collection of the Vienna Natural History Museum.....456
CHAMPLAIN, A. B., AND KNULL, J. N.—Two New North American Coleoptera (Buprestidae and Cerambycidae).....469
BAERG, W. J.—The Effect of the Venom of Some Supposedly Poisonous Arthropods of the Canal Zone.....471
BEAMER, R. H.—Notes on the Oviposition of Some Kansas Cicadas.....479
BARROWS, WM. M.—Modification and Development of the Arachnid Palpal Claw with Especial Reference to Spiders.....483
GILLETTE, C. P., AND PALMER, MIRIAM A.—Two New Species of the Genus Lachnus.....526
ABBOTT, CYRIL E.—Associative Memory in the Larvae of Anax Junius.....533
HILTON, W. A.—Some Remarks on the Peripheral Nervous System of Insects..537

295475

DATES OF ISSUE FOR VOLUME XVIII.

March Number Issued April 6, 1925.
June Number Issued July 17, 1925.
September Number Issued October 6, 1925.
December Number Issued December 30, 1925.

ANNALS

OF

The Entomological Society of America

Volume XVIII MARCH, 1925 Number 1

THE NEEDS OF THE WORLD AS TO ENTOMOLOGY

L. O. HOWARD

I have chosen an ambitious and rather sweeping title for this address. It would make a good title for a book. I may possibly use it as a title for a book I have been preparing for some time. It will serve my present purpose, however, to head some thoughts that have come to me after about sixty years of greater or less attention to insects.

Not so many years ago this would have been considered a mixed audience, an audience surely at one in that all are interested in entomology, yet mixed since it contains investigators whose sole aim is apparently the study of this vast assemblage of extraordinary forms of life in some one or several of its aspects from that ennobled curiosity which lies at the bottom of so much valuable scientific research—the effort to answer the continual questions "why" and "how"—and since it contains also investigators who are striving to overcome the agencies which are destroying many of the vital needs of the human species.

But now it is coming fully to be recognized by all of us who are working with insects that, while the man who is trying to supply *immediate* relief from great loss by the most *immediate* measures is the man for the *immediate* emergency, every man who studies insects and who records his results is doing greatly needed work and work that sooner or later will help to lead to a close understanding of insect life which may bring about its control by man.

295475

I will not speak here of the rapidly increasing appreciation by the intelligent part of the public of the tremendous importance of entomological work; but of another fact, which is that, in spite of the good we have done and are now doing, month by month the insect problem becomes more serious. It is far more serious today than it was twenty years ago, although the workers in economic entomology have doubled in that time and the money expended in entomological investigations has probably trebled. It is enormously more serious than it was fifty years ago when a mere handful of men were laying the groundwork for our rapidly growing structure. This may look to the carper or to one who loves to chaff his entomologist friends as a possible case of cause and effect—the more entomologists, the more insects and insect damage! But to the knowing mind it is perfectly obvious that, just at the time when the crisis of overpopulation of the earth is approaching, just at the time when the total human food supply must rapidly be increased, the multiplication of injurious insects is helped in a way by the very methods man has adopted in his civilized life.

Instance after instance in illustration of this fact will occur to you. Let us look at the cotton boll weevil. Here is a species that gradually developed its close adaptations to cotton in Central America where the cotton tree grows wild. It was a nearly unknown creature of slight economic importance. Brought by accident across the Rio Grande at Brownsville, and then more or less by accident to Alice, it found itself in a boll weevil heaven—a whole state growing its favorite food, and growing it in just the way to make life a delight, in just the way to promote to the utmost limit its extraordinary powers of multiplication, and so its enormous progressive spread until now the whole vast cotton belt is occupied. Incidentally it may be said that all this might have been prevented had the advice of entomologists been followed in the beginning, and that at a later date the spread might greatly have been retarded and the damage very greatly lessened had the southern cotton planters generally heeded the advice of the experts.

This will answer as an illustration in regard to agriculture. With regard to human health the same conditions hold. For example, it may be shown that the advance of civilization in a new country at first reduces malaria, by the drainage of swamp

areas and the reclaiming of moist "bad lands" for agriculture, only to be followed, as the country becomes densely settled, by the reappearance of malaria, since man has made new and even better breeding places for the malarial mosquitoes than were the old swamps: the making of mill-dams, of stone quarries, the stopping of extremely small streams of running water by railway embankments, the digging of borrow pits, the accumulation of old tin cans and disused vessels of one sort or another about towns, even the footprints of cattle in soil that is not too dry, especially during a rainy season, and in countless other ways, such as water troughs for cattle, small ornamental ponds for aquatic plants, the water receptacles for grindstones, poorly protected cesspools, imperfectly covered water tanks, the catch-basins of sewer systems, the badly-cared-for roof troughs of houses and barns, even the perfected and up-to-date water-closets in houses temporarily vacated, and so on and so on.

Attention has often been called to the increasing spread of injurious insects from country to country by the rapidly increasing speed of ocean voyages. Our latter-day Japanese beetle and European corn borer inspectors appreciate as can no one else how the hundreds of thousands of automobiles and our greatly improved roads help the spread of these and many other pests. As early as the peace conference at Portsmouth at the close of the Russo-Japanese War, when thousands of vehicles from regions infested by the gipsy and brown-tail moths brought their loads of sightseers to Portsmouth, there resulted an immediate extension of the range of these imported pests. And when T. Chalmers Mitchell and his companions attempted to fly from Cairo to the Cape a few years ago, the possibilities of the airplane as a spreader of insects was demonstrated, as I heard Mitchell state at a meeting of the Zoological Society of London in 1920.

So what is termed "advancing civilization" is not only encouraging insects to multiply almost beyond bounds, but it is facilitating and hastening their spread in many ways.

In the face of all this, what we have done and what we are doing, much as we have accomplished, especially during the past twenty years, is a trifle—a comparatively insignificant series of things done and learned compared to what we have still to do and to learn.

In the first place we must have the public behind us. The public must be made to appreciate the fact that it is a vital necessity to the future of humanity that we should learn everything about insects; that keen and highly trained men should be studying every aspect of insect life, and that chemists, engineers, plant physiologists, bacteriologists and scientific men of many specialties must be called in. They must learn that the study of no aspect of insect life is a trivial pursuit, as their fathers thought, and they must learn that the entomologists are the men on whom the world must depend for much of its future prosperity.

This education of the public is going on rapidly, but we must help to speed it up. A number of strong writers in the newspapers and in the magazines have found the topic attractive and interesting. Many of us have grasped opportunities to address lay audiences of all kinds on the general subject, and all of us who can speak more or less forcefully in public must never lose a chance to drive this particular lesson home.

Incidentally there is an enormous opportunity in the teachers' colleges, in the great summer sessions of such institutions as the Teachers College of Columbia University in New York, for example, where twelve thousand teachers from all over the United States come together hungering for information to take back to their hundreds of thousands of pupils everywhere.

Many of you may have noticed that a committee "on the place of the sciences in education" has been constituted by the American Association for the Advancement of Science. This committee includes representatives of high schools as well as of universities and others. There is a place under this committee for the consideration of secondary-school science. In an article by Dr. O. W. Caldwell in the journal *Science* for December 12th, last, there is much information regarding the teaching of science. A significant table, for example, is given of the distribution of over forty-seven thousand high school pupils in Washington in the different subjects in which they were enrolled. Of a total of 6,332 in science, 1,061 were enrolled in zoology. Here obviously is an opportunity for the stressing of the duty of teachers to include work in entomology, and the representative committee in charge of this subject should add an entomologist to its members as a preliminary step to the securing,

not only in high schools, but in secondary schools as well, of such instruction in entomology as will arouse the interest of boys and girls in entomology and *make them realize its enormous importance.*

I am perfectly aware that what I have just said may sound as though it were intended for economic entomologists only, but I must emphasize again and again that there is no entomologist, whatever his line of work, who is not concerned and who is not helping very greatly.

Next to the education of the public, the number of workers must very greatly be increased; and public education will undoubtedly lead to this increase, since, by the stimulation of the interest of the people, the minds of capable young men and young women will be open to the call for service, funds will come from legislative bodies and the way will be opened.

With the education of the public should come (and I hope it will) a great increase in the number of so-called amateur entomologists. We all know that men of this class have done magnificent work in the past; that in fact they did the bulk of the work down to comparatively recent years, and that they still constitute a very large percentage of the numbers of most of the great entomological societies.

How many so-called entomologists are there now? It is difficult to say. In the last edition of Cattell's "American Men of Science" there are approximately 9,500 names. Of these, 217 are recorded as entomologists. I have recently estimated the number of members of the large publishing entomological societies of the world and find that they probably reach over 6,000 and of these more than 2,000 are American. This latter number must be reduced, however, on account of the fact that so many individuals belong to two or more of our societies—notably the Entomological Society of America and the American Association of Economic Entomologists. In the 1924 edition of Cassino's Naturalists' Directory, which includes all kinds of collectors, teachers, and so on, there are approximately 4,450 names. I have checked the names of those indicating any interest in entomology and they number 923.

But this stimulation of popular interest must go further than the man in the street—the average citizen; it must uncloister our schools and colleges, not alone the minds of the students,

but especially the minds of the teachers. The insect complex should receive the prime attention of a vastly greater body of trained research men in the universities.

In my presidential address before the American Association for the Advancement of Science in December, 1921, I stated that I had examined the titles of the theses for doctorates in American universities for the preceding eight years and found that only a very small percentage of the output "represents work which can be of the slightest use to humanity in its immediate problem regarding the insect world, and, even those which may prove of use, bear some evidence that the lines of study had already been adopted by students who used them incidentally to gain their degrees and were not suggested by their teachers as promising lines leading towards some great practical outcome."

I have recently examined the titles for theses for the doctorate degree in American universities for 1922, and find that, of 442 such theses, 39 concern zoology. Of these 39, 19 were concerned with insects, which is apparently an improvement on the earlier situation; but of these, 5 were papers on genetics in which Drosophila was used, and only six of them had any apparent economic bearing. The other eight, however, represented good, sound work, and the results of the investigations on which they were based undoubtedly will help in our broad aim to understand the insect class.

Dissatisfied as I am with this small proportion among the zoological theses, I am naturally equally disappointed in the small proportion of theses that concern any aspect of zoology, and I am disappointed at the small number of *all* of the theses for doctorates. The time is coming—and we must do all that we can to hasten it—when not only will research students be at work in our universities in much greater numbers, but when those applying themselves to entomological subjects will be multiplied many times.

In this broader training of the coming workers in entomology the latest conceptions in biology and the latest methods will become known to them and will influence their work. We see this coming rapidly today. The mathematical trend in biological work has not been sufficiently noted by many entomologists. We cannot afford to neglect this movement.

If we do neglect it we will lose the significance of much of the research literature of biology, and in our own work will lose the good to be gained from these mathematical methods.

This has naturally led up beyond the discussion of the needed increase in numbers among the entomologists into the need for broader and sounder training. And this in turn will lead us to a consideration of the direction of this research training and the vast opportunities which exist for the most important research. To do this properly we must know comprehensively where we stand today.

In morphology we are most fortunate at this present moment to have at hand (only a month from the press) that magnificent "Introduction to Entomology" by Comstock, its thousand pages displaying this side of entomological accomplishment to date, the result of long years of close and careful work by a great student and teacher.

I have used the term *morphology*, in referring to this great work, as including external and internal anatomy and taxonomy. Physiological information occurs frequently in the consideration of anatomical points, and embryological data are touched upon here and there. In the consideration of metamorphoses also the treatment is broad beyond the usual understanding of the term *morphology;* and habits, behavior, life history data, and points suggesting ecological work are touched all through the bulk of the book. So in a big way this "Introduction" is much more than an introduction to entomology; it is an introduction to the *new* entomology that is to come. We may take it as a starting point from which to proceed, just as the older entomologists took Westwood's famous "Introduction" and, later, Sharp's "Insecta," and as the men of the generation of Walsh and Riley and Thomas and LeBaron took the classic "Insects Injurious to Vegetation" by our own Thaddeus William Harris.

Before leaving the subject of morphology, attention should be called to the advanced and most competent work of Snodgrass, some of which is already available and much more will soon be available. Comstock's mention of the work of this gifted entomologist, on page 205 of the new "Introduction," is a deserved and gracious act of the veteran.

I think that the subject that has been most in the minds of many of us in recent years has been insect physiology. After scores of years of work by brilliant men, our knowledge of the physiology of the human species still has many gaps. How much more, therefore, with its pitifully small number of workers, is there to be learned about insect physiology! Fundamentally radically different from the vertebrate structurally, how importantly must their physiology differ! And upon their physiology as greatly as upon their structure must their behavior depend. In the main, we know what they do only as it affects our interests. We must know everything that they do and why and how they do it. Here physiology is basic. To understand their reactions, to be able intelligently to explain their tropisms, we must know how they direct their movements, how they communicate, how they hear, how they see, how they digest their food and the scores of other things upon which a complete knowledge of their physiology would throw light.

I think it is quite certain that this is the largest as it is surely the most important of the comparatively unexplored fields in entomology. What information there is exists in scattered papers in many languages, and many of the investigations in so-called physiology are really little more than studies of internal anatomy in which the histology of organs is considered from a more or less comparative point of view. Enlightening work has been done on the structure of the sense organs, notably that of McIndoo on the olfactory organs of insects of several different orders. But physiology in general from its experimental and chemical aspects has hardly been touched. Such studies as have been made are not assembled so that we can readily know where we stand. Although the first part of Packard's Text Book is entitled "Morphology and Physiology," and covers over five hundred pages, it is almost wholly anatomical and it is twenty-six years old.

One of the greatest and most important fields in human physiology and in that of domestic animals, and one which is being most intensively worked, is that of nutrition. What do we know about the food elements necessary to insects? And just how is this food utilized? Here is a field which is crying for investigation by the best trained men, using the most advanced methods and able, in fact, to invent new methods—men of the genius of Krogh of Denmark, for example.

As already indicated, upon our knowledge of the physiology of insects must depend our understanding of their tropisms, and upon a clear understanding of these tropisms will depend many of our future methods of warfare.

When we speak of tropisms and behavior we are touching upon what stands for psychology with insects. Recently, in the World War, we have had a striking example of the enormous handicap to a battling nation of a lack of understanding of the psychology of its antagonists. It is a far cry from the varying psychology of the different races of human beings to the vastly different psychology of insects. But how important it is to attempt at least to understand such psychology as they possess, and how little do we know about it now! But we have a beginning. Bouvier's admirable "La Vie psychique des Insectes" brings together what we know now, and therefore forms a starting point for experimental work and study which may lead to important results.

The psychology of insects, of course, brings us at once to the disputed borderland of instinct and intelligence. We are none of us ready to adopt Ferenczy's classificatory name for the human species (*Homo immoralis semisapiens*) as contrasted with his ant name (*Formica sapiens diligens*), nor do we misunderstand Wheeler's exquisite satire on human society which he entitled "Termitodoxa," but, for want of a better name, we may call *psychological* a lot of insect phenomena which need investigation.

Insects are controlled by nature very much better and more effectively than by man himself—assuming that man's efforts are not a part of nature (as they surely are, since man is a true ecological factor). Many more insects are destroyed by their parasites of different kinds and by their other natural enemies than are destroyed by man. In fact, man has really been making things easy for the insects—he has been facilitating the multiplication and spread of his own worst enemies, and at the same time he has been groaning and complaining and suffering from the effects of his own stupidity.

The trite words "going back to nature" have an especial significance in this connection. We cannot go back to nature, in a way, if we wish to preserve our rank as the dominant species and still keep on increasing all the time. We must continue to "upset the balance" and keep on upsetting it more and more if

we are to feed our increasing millions. We must control all possible food resources. But we must get back to nature in so far that we must study all these natural control factors as they affect antagonistic species, and we must utilize them.

But to utilize them we must first understand them, and the word *understand* does not mean half knowledge. Generalizations are nowhere more dangerous than here. I have been studying some of the smaller aspects of this subject for more than forty years, and I have seen my imagined or expressed generalizations fall by the dozen through the work of keen-eyed and competent younger observers. And yet the enormous complex of interacting organisms, really fighting desperately among themselves, is only just becoming apparent, and offers a field for many keen workers for many years to come. And it is a field of very great promise. It is one of the fundamentals.

The complexity of the problem is growing on us. What we once thought simple becomes the more involved the deeper we go into the subject. But these very complications as they arise should only render the subject the more attractive to the truly scientific mind. Nowhere do we run up against a stone wall; but the more we observe and the more we study, the more the field opens before us and the closer we come to a true understanding of relations and the more apt we will be to find principles and ideas that will be of value from the human standpoint.

Insects are a healthy race. They have in these fifty million years bred out the unfit. And their very prolificacy more than compensates for the losses caused by occasional epidemics. But in the study of natural control, insect pathology, a largely neglected field, must have more workers. We must know here, just as in every other possible line of insect research, every fact that can be ascertained. Of course, the insect pathologist will be working for an end diametrically opposed to that of the human pathologist, but the basic technique of the latter will help the former, and the causative organisms of disease have a certain zoological or botanical grouping which will render the work of both groups of pathologists at least comparable. There are great gaps to be filled in our knowledge of the forms of parasitism in which protozoa, bacteria, fungi, helminths and filterable viruses are concerned.

In this direction the work of Pasteur on pebrine stands out, and the results of subsequent investigations of this disease have been incorporated in a number of papers, especially by Italian investigators. The diseases of bees have been investigated by our own G. F. White and A. P. Sturtevant; and Burri of Switzerland, Bahr of Denmark, and Maassen, Bochert and Zander of Germany have contributed to the study of bee diseases. Kudo of Japan has worked upon the Protozoa of insects, and a number of medical investigators have been led to study the micro-organisms in the digestive tracts of insects that bite man.

Paillot of France is making profound studies of the micro-organism fauna of the insect body. Metalnikov of the Pasteur Institute in Paris has been working on the blood of insects and making studies relative to the problem of immunity, using largely the larvae of the wax moth. Rudolph Glaser and G. F. White of the United States are studying the pathology of insects.

Nearly all of these workers, however, have spent only a portion of their time upon such studies and have each contributed only a few papers. Systematic, consecutive, well planned work by many men, perhaps in cooperation, must be brought about.

From the fact that certain disease organisms inhabit both insects and warm-blooded animals and that with some of them this dual host relation is a necessity in their lives, we are led to the subject of medical entomology.

It seems to me that no wise man can for an instant believe that medical entomology has passed its infancy. To all intents and purposes this branch of knowledge was first opened up less than thirty years ago. Its increase has been dramatic. Three years ago, at the invitation of the President of the American Public Health Association, I wrote the "Sketch History of Medical Entomology." It was a subject with which I had been connected since its beginning. It was a subject of vital interest. Discovery had followed discovery with such rapidity and the results which followed these discoveries were of such enormous importance to humanity that the story fairly wrote itself. The subject has developed so rapidly and has spread out in so many directions that it invites and in fact demands the keen attention of many workers.

It is true that most of the main discoveries have been made by medical men, but all future work demands the intimate cooperation of pathologists and entomologists. The control of an insect-borne disease, whether of man or domestic animals or cultivated plants, means primarily the control of the vector; and who so competent to investigate the possibilities in that direction as the man trained in economic entomology?

Not so many months ago, traveling for a day or two in the company of the principal officer of one of the great medical research institutions, I suggested to him that a well equipped service should be started, preferably at some great scientific center, where the intimate biology of all insects known to be carriers of disease should be investigated by competent men, untrammeled in their work and assisted to the limit of their necessities in a financial way; that these men should include in their investigations not only all known vectors but all of the close relatives of such species. I am sure that my suggestion was sound; that the establishment of such a laboratory or series of laboratories is a great desideratum; that the results to be gained by such work could not fail to be of very great benefit; and I therefore advanced the project with some assurance. To my disappointment, however, it was received with an interest which was obviously only a matter of courtesy, and I dropped the subject in discouragement. But why should not such a plan be pushed? Let some man yet in his forties draw up a scheme in as much detail as possible; let him consult with his wisest associates; let him look over the field with a prophetic eye; and then push the plan with an enthusiasm and energy which belongs rather to the fourth decade of life than to the sixth (now occupied by the writer). Of course it is quite possible that this idea may not be adopted, but in the very outlining of the plan it will be necessary to bring together all the sidelights with the main idea, and out of it will come unquestionably a stimulation to research of the broadest kind in this vital direction.

And now we come to ecology. Originating as a name not so long ago among the botanists, this term has broadened in its significance to include certain aspects of the whole biological field. In his masterly address delivered before this Society in 1915, entitled "The Ecological Foundations of Applied

Entomology," that deep and sound thinker, that broad naturalist, that man whom this Society and our sister societies have been proud to honor as the dean of the economic entomologists of America, Dr. S. A. Forbes, pointed out in his clear and forceful way that nowhere does the broadening of biological studies into the field of what is now termed ecology promise better results or greater opportunities than in applied entomology. In fact, he says, "The economic entomologist is an ecologist pure and simple—whether he calls himself so or not * * *." This wonderful address and the contemporaneous and subsequent writings of Shelford and others have opened the eyes of many workers— in fact, have made many productive workers—and all leaders of main projects having insect control in mind are now looking upon their problems with ecological eyes.

The revolution which has come is well illustrated, for example, in the October, last, number of the *Canadian Entomologist*, where the leading article, by W. C. Cook, tells of a study of the Noctuid moths caught at light at Bozeman, Montana, in 1919 by K. M. King and in 1923 by himself. Even a dozen years ago the moths so caught, if they were good specimens, would have been pinned, identified and put in the college collection or in a private collection, accurately labeled of course with date and locality, and there the matter would have rested. But with our present growing knowledge of the factors concerned in the ecology of insects and the importance to be placed upon an accumulation of individual notes, Mr. Cook has gone far: he has analyzed the results, taking into consideration the food plants and habits of the species involved, the question of temperature and rainfall and elevation and character of the country inhabited by the individual species, and has been able to draw from all this the following conclusion:

"The insect fauna of a given region is not a single stable unit, varying only in abundance from year to year, but is a composite of smaller groups, each of which has more or less definite optimum. The composition of the fauna in a given season is very definitely related to the climatic conditions prevailing at the time of growth. Three dry years culminating in 1919 enormously increased the proportion of prairie elements in the Bozeman fauna, while reducing the eastern and mountain forms. The trend of the climate toward normal has resulted by 1923 in a great reduction in these prairie intruders, and the re-establishment of the eastern and mountain forms. How much farther this movement will go cannot be predicted, but it is certain that a return of dry weather will reverse the direction of the trend."

I select this instance because it concerns a paper that was published only the other day, but recent entomological and ecological journals contain numbers of articles of equal or greater significance. What an advance! In the general warfare against insects those conclusions will seem to have no immediate bearing upon any problem, but they are valuable and very suggestive and indicate great progress in entomological thought and methods.

I find a confident prophecy as to the effect of work of this character in a paper by C. H. T. Townsend in the journal "Ecology" for January, 1924. He says, in closing:

> "Environment work will be the first and last steps in the insect control of the future. The normal favorable environment must be changed to an unfavorable one. Given the *factor values* in the *environment classes* to which the insects' phases are subjected, with the insects' *responses* to the same, we are in the most advantageous position for deciding which phase to attack and which environment class to manipulate in order to gain control."

Here the factor values include heat, sunlight, rainfall, atmospheric humidity, atmospheric pressure, wind, soil texture, soil moisture, vegetation, food supply, predators, parasites and disease.

I remind you of this prophecy without absolutely complete endorsement, but as an especially notable paragraph.

We must not leave this subject of ecology without mention of Hopkins' promising work on bioclimatic laws. It is a subject to which this able thinker is now fortunately able to devote his principal attention. He has already arrived at conclusions of farreaching value—far beyond the confines of economic entomology—and it is hoped that this great work will receive the appreciation it deserves.

To be able to know precisely and definitely what creature is before one—to be able to write about it in such a way that all other workers will understand—necessitates a system of classification and the naming and technical description of a host of forms. The comparative study of morphological characters, of course, indicates relationships, presupposes similar methods of development and similar behavior among the related forms, and in addition it affords evidence as to lines of descent and the general trend of evolution.

In spite of the hundreds of thousands of species of insects that have been named and described, a greatly larger number remain unnamed, while the stability of the names already adopted and of many of the classificatory details and systems has by no means become fixed, and there is a sad lack of comprehensive catalogues of groups—a type of publication of the greatest use to all entomologists. There is, therefore, a crying need for many more capable taxonomists.

Further than this, there is also a crying need for bigger and broader taxonomists—for the men now at work to become bigger and broader, and for the men entering the field to consider a host of things unconsidered in the old taxonomy. The average taxonomist of today is lagging behind in the advance of science. New species continue to pour in at such a rate that his time is constantly occupied with descriptive work. He is seldom able to apply himself to an extended revision of a given group, and if he does attempt such a revision he fails to consider even the small amount of work that has been done in internal anatomy, embryology, physiology and paleo-entomology. His system cannot be absolutely sound, because he is not able to go deep enough. We need a sounder and better based classification all through the group Insecta, and this is one of our prime needs today. The basic value of a stable nomenclature to all workers in all phases of entomological effort, applied or not, needs no argument here; it is obvious to all of us who are engaged in economic work; it is obvious to those who have done work in embryology, morphology, genetics or any other branch of biology in which insect material is being used.

Taxonomy with the class Insecta is complicated beyond that of most other groups of animals by the existence of complete metamorphoses and the radical difference in the lives of the larvae and of the adults; a fact which brings to bear on each stage many evolutionary factors entirely different from those acting on the other. This demands the consideration in taxonomy of what we used to call "life history work," and it is in this life history information and in exact knowledge of early stages that there are very great gaps. Fortunately, the work on the life history of any one species or another is fascinating, and always attracts workers. The number of such investigators is increasing rapidly, and gaps are being filled.

We are sadly lacking, however, in our knowledge of larval forms and in our ability at once to identify larvae without first rearing the adults. In practical work, and especially in international or intersectional quarantine, the most comprehensive knowledge of larval forms is necessary, since in the operation of commerce insects are carried accidentally quite as often in the larval form as in the adult form.

Work upon larval stages is going on at the present time with some groups of Lepidoptera, certain Diptera and the Coleoptera. Perhaps the most ambitious effort of this kind is that with the last-named order. It is a great pleasure to know that Böving and Craighead have almost finished characterizations, keys and short diagnoses of the families and subfamilies of the entire order Coleoptera.

And, speaking of quarantine work, we should not only be able to identify material found in whatever stage, but there is a great deal that should be known which does not come properly under this portion of this paper. It is becoming plain that quarantines may be promulgated which are unnecessary. We have been obliged to go on the presumption that a pest in a given country may be and probably will be a pest in another country; but such a decision cannot be made with full justice without a knowledge of the ecology of the species in its original home. It would virtually be impossible for any nation to carry out investigations of this kind within the territory of another nation for any number of species without international agreements and without the expenditure of large funds, but, if we had known, for example, in this country, in advance of the advent of the European corn borer, the ecological facts concerning this species in Europe, which Mr. K. M. Babcock is at present studying over there, we would have been in position to attack the problem, perhaps not much more confidently, but with a more exact idea concerning the possibilities of spread.

Cooperation is the key-note to success in all great undertakings. (Pardon this trite statement, tritely put!) In this effort to gain a perfect knowledge of insects and, through this knowledge, to control them, we are engaged in one of the greatest of all undertakings; and it is not alone for the benefit of our own people—it is for the benefit of humanity. Therefore, in this great effort let us never forget that we must freely urge

the help of men working in other branches of science—that we must be keenly on the lookout for points where they can help us—that we must plan our investigations with the idea that others will help, and we must call them in consultation in making our plans. For many of the needed types of investigation we as entomologists must train ourselves to be self-reliant, but as we broaden out we must beg the help of experts in many different lines. Any one of the many discoveries being made in physics, chemistry or other sciences may touch or may be made to touch our investigations looking toward the control of insects. Some discovery now on the point of being made in one of these sciences may lighten our task.*

Primarily in agricultural entomology must we consult the wisest experts in farm management—the clearest-thinking agronomists. We realize, as I have already pointed out, that with many of our methods of farm practice we are encouraging the multiplication and spread of many insects; we are fairly inviting them to overwhelm us. Why waste years of work trying to fight them in one way or another under existing conditions if it be possible, after a full understanding of their ways, so to vary crop methods as to hit a vital point in their economy without materially lessening crop production? This has been done in a number of instances. Only the other day one of our English colleagues (Frew) advised a slight and inexpensive variation in the manuring and cropping of barley which will do away with the damage by a serious insect enemy. A careful study by an expert agronomist of the life-history facts already learned by us about a number of our principal injurious insects will undoubtedly lead to valuable ideas and to the endorsement, from a far-seeing practical side, of suggestions in this direction which some of us may have made.

There is no scientific man whose cooperation the entomologist more needs than the skilled organic chemist. There are scores of problems of great importance to which the labors of such a man or men should be turned. In the chemistry of the physiological processes in the insect body, he is needed; and he is especially needed in the study of the chemistry of the plants

* Mention may be made here of Prof. C. K. Brain's just-announced discovery in South Africa of the adaptation of certain radio principles to insect investigation, in which he shows that, by the use of microphones, the presence of insects may be determined, not only of wood-boring insects, boring in wood, but of insects in stored grains.

upon which insects feed, in the effort to understand fundamentally what there is about certain plants that attracts certain insects. For many months now that famous investigator, Dr. Frederick B. Power, with the able assistance of Mr. V. K. Chestnut, has been studying the chemistry of the cotton plant, and this is being done on a scale and with an expenditure of time and care never before equaled in such a study. The results already obtained have been of the highest interest from the chemical point of view, and also from the point of view of plant structure and physiology; and there have been developments which may prove to be of great importance to the economic entomologist. It would not be proper for me to make more than this mere statement, but a preliminary paper is being prepared which will contain many astonishing facts.

The Chemical Warfare Service of the Army is carrying on an elaborate series of tests against insects with different gases, and has a great accumulation of records which when published will be of undoubted value if only as records. These tests, in the main, have been made in cooperation with the Bureau of Entomology. There is an exception in the case of tests against the cotton boll weevil, for which a direct appropriation was made to the War Department on the initiative of a southern Senator. Even the tests from which there have been no obviously valuable results will have an ultimate value to future experimenters. It is therefore to be hoped that the secrecy which necessarily must surround Army experimental work with poison gases that may be used in warfare will not prevent the near publication of a record of the exact experiments of the Chemical Warfare Service against insects.

It is true that certain other chemists have entered this field. George Gray, of California, has a large manuscript on the chemistry of insecticides, not yet published, but he has been drafted into the service of the State in a somewhat different capacity and is no longer able to devote his whole time to this important side. William Moore, from whom we expected and still expect great things, has joined a commercial organization. There is this to be said for chemistry, that industrial corporations are employing numbers of research men and that therefore the very research which we need may be and is being supported financially by such organizations.

We must look to the chemist for the development of the most perfect insecticide, which as likely as not will be a synthetic organic compound. We must look to him for that greatest desideratum, a cheap compound that will at once stimulate plant life and deter or destroy insects.

There has grown up in these past years a beautiful spirit of cooperation among the entomologists all over the world. I doubt that such a spirit exists among the workers in any other branch of science. Each one of us has held himself in readiness to be of assistance to any one of his colleagues of whatever nationality. But we must not be satisfied with this. The needs of humanity demand both a broader and a closer association. The prime insect pests of the world are, through commerce, as we have shown, becoming widespread, and the self-protection of nations demands the most intimate knowledge of the injurious insects of all countries, since all of them are potential pests of other regions. This subject was considered at some length at the recent Pan-Pacific Food Conservation Conference, and one of the resolutions adopted at that Conference recommended the appointment of an international crop protection committee to promote surveys, to encourage research work, to promote the development by each country of larger numbers of trained workers, and to obtain agreements and understandings between countries regarding the giving of prompt notification of the appearance of new pests and to secure the cooperation of countries in the prevention of spread.

All these points that I have considered will no doubt be sufficiently obvious to you, and very possibly have been in your minds. There is a host of lesser suggestions that may be made, our needs are so very great. But this is not the place to go into an extended category of lesser things.

As I come to this point I realize more than ever that I have been writing all the time as an economic entomologist. Down to very recent times there has been a class distinction between the economic entomologists and the other workers, especially the taxonomists of the museums and workers in many laboratories. As the field has widened out, as the seriousness and vastness of the situation confronting humanity becomes apparent, these workers have been coming closer together; the economists have felt the importance of the labors of the others.

The vastly greater part of the work of the economist has not been basic; it has consisted largely of an effort to apply known facts to special problems. The emergencies confronting him have been so great that he has had no time to conduct the long investigations that might give him other weapons than those nearest to his hand. His fight has been so strenuous that in a way he has lost his perspective.

But he has done magnificent work. He has confronted many difficult situations with success, *and with simple weapons.* But the great basic principles which have brought about the conditions which he has been called upon to meet have not been considered by him in his haste for immediate relief measures. He has available no more than a superficial knowledge of the forms he is trying to fight. It is true that he has carefully worked out in a more or less general way the life histories of many of the crop pests, but beyond that he knows little of what must be known.

I have just stated that he has waged a good fight "with simple weapons," but this must not be taken in a derogatory way. An admirable book, which (patriotically) I wish had been written by Americans, was published in England in 1923 by R. A. Wardle, of the University of Manchester, and Philip Buckle, of the University of Durham, which gives a review of an advanced and encouraging character of our knowledge of "the principles of insect control."

It so happens, to consider things concretely, that an appropriation bill now before Congress allots for the fiscal year beginning July 1, 1925, more than $2,500,000 to the Bureau of Entomology; but of this large amount more than $1,200,000 must be spent on the three specific problems of the gipsy moth, the European corn-borer and the Japanese beetle, in the effort to prevent their spread and to gain at least partial control. And the remaining sums are for the most part to be spent in the study of special crop pests. In other words, at least half the amount, although it may be continued in future years and will probably be so continued, should really be termed emergency funds, funds appropriated to meet immediate and specific emergencies.

It is an interesting thought that, looking toward the future, this large sum would probably be much more productive in the long run if it were spent in the effort to learn fundamental things along some

of the lines we have touched. If this idea seems overdrawn, in view of existing conditions, it is none the less surely true that large sums must be forthcoming to support these greatly needed lines of research.

Last winter, toward the close of the Cincinnati meeting, I felt growing within me a conviction that we are on the eve of startling discoveries in economic entomology. I spoke of this to several leaders, and found that they shared the feeling. The conviction has been growing since, and may well be realized. But this does not lessen the certainty that it is our duty to labor diligently in our efforts to gain a complete understanding of insects. The comparative paucity of our present knowledge should be a tremendous incentive.

The entomologist has come into his own. He is acknowledged and respected by workers in other branches of science. The importance of his labors is recognized by the most important part of the general public. To justify this, and to increase it, demands that we work earnestly, that we make a strenuous effort to increase our numbers, and that we broaden our views and our methods.

SPECIAL NOTICE TO ALL MEMBERS

The revised list of members, their addresses and the taxonomic groups in which they are interested and those in which they are willing to make determinations, is being prepared for the June number of the Annals. Each member is urged to make sure that the Secretary has been informed regarding any recent changes of address and also that he has up-to-date information on the other points mentioned. If this number of the Annals is not correctly addressed please advise:

C. L. METCALF,
Natural History Building,
University of Illinois, Urbana, Ill.

THE HYPOTHETICAL WING OF THE HYMENOPTERA

WM. T. M. FORBES
Cornell University

The hypothetical plan of venation of the Hymenoptera as derived by Comstock and Needham is largely based on analogy with the condition in the more specialized Diptera. It involves the assumption that there has been a good deal of fusion of the apices of veins, and largely ignores the evidence of the tracheation.

The recent study of the Coleoptera (ANNALS Entom. Soc. Am. 15, 328) suggested an alternative scheme, assuming that specialization in the original Hymenopter had taken practically the line it has in early and moderately specialized beetles; and this alternative is worked out here. The following assumptions are made:

1. That the tracheæ are trustworthy as a general guide to the homologies of veins, but that some switching has taken place, especially where a sector of a vein has atrophied.
2. That the base of vein M is lost, involving an interruption in the trachea; that the base of the trachea M has weakened and then become obsolete, and that the apex is attached secondarily either to R or Cu.
3. That trachea 1st A is lost, and normally the vein also.
4. That the branches of the main veins have largely disappeared, leaving R with three branches, and M simple, but that a considerable number of cross-veins are preserved, and that primitively, 2d A, 3d A and 4th A are dichotomous, as in various orders of Holometabola.
5. That 4th A is fully preserved and bifid, the lower fork being short and running directly to the inner margin at the beginning of the cord, and the common stem running almost transversely.

This is the same set of assumptions that were made in interpreting the Coleoptera, where the more primitive forms give good evidence of their truth.

The second and third modifications have obviously taken place in the Cerambycidæ, as may be proved by comparing the

tracheation of a Cerambycid, figured by Comstock and Needham (see "The Wings of Insects," Figs. 308–310), with that of *Tenebrio* or *Dytiscus*, figured in my paper.

The fourth assumption is the crux of the whole matter. In the case of the Coleoptera I felt it was a safe one, both on account of the suggestion of terminal forks of R and M in the Hydrophilidæ, and the frequent reduction of M in the Neuroptera, which seems to be the one of the more primitive orders most closely related to the Coleoptera. In the Hymenoptera it is hazardous, but leads to a consistent result and agrees with what tracheal evidence there is.

The drawing of *Tremex* (Fig. 1) will show the resulting plan. In the figure tracheæ are indicated by solid lines, veins not provided with tracheæ by dotted ones.

Costa is simple and complete, ending abruptly at a notch on the costa.

Subcosta and *radius* were represented by a single trachea in the specimen figured. More frequently there are two tracheæ in the base of the wing, which become coincident farther out. This combined trachea forks into three, opposite the break in the costa. The first of these makes the anterior boundary of the pterostigma, and is therefore Sc_2, as in other orders; the second continues the main vein, and the third bends abruptly down and then out, running into the apex of the wing. As I interpret it, this branch divides no more, and represents R_{4+5}, the transverse veins below it being cross-veins. The more anterior branch is provided with a bifurcated trachea, which is also recognizable in *Ceratina;* the upper branch forms the lower edge of the stigma, and so must be R_1, the lower may be presumed to be R_{2+3}. It anastomoses with R_{4+5}, as in the majority of Lepidoptera, and then its apex reappears in the Xyelidæ as a branch running to the costa (Fig. 6). The interpretation of the appendiculate cell is perhaps doubtful. Ordinarily the vein which I call R_{4+5} is considered to turn up to the costa, and later develop a secondary vein at its bend, running to the outer margin. I have assumed that the latter vein is the true continuation of R_{4+5}, and that the vein running across to the costa is a cross-vein (marked s in the Figure). There is a similar uncertainty in the case of some of the higher Diptera, as noted by Tillyard.

Media is the next trachea. Its basal part is weak and soon runs out in the specimen figured; in others it may be completely absent. When present it lies in the cavity of R. Then there is a gap, and the outer part appears as a heavy longitudinal vein and trachea connected by a heavy stem to Cu, and by weaker ones to R. This condition corresponds to that in various Coleoptera, where the base of the medial vein has atrophied, while the outer part of the medial trachea is supplied from Cu, and entirely independent of the rudimentary base. In the

Coleoptera the origin of the condition can be traced; as in primitive forms M is nearly complete, and its trachea is complete and independent. I assume that the three or four transverse veins connecting M with R, and the three connecting it with Cu are all cross-veins; part of them may contain tracheæ, but not the same ones in *Tremex* (Fig. 1), and the bee, (Fig. 3).

On *Cu* the tracheal evidence is clear in *Tremex*, and if approached without preconception I think it is conclusive. Cu has a single strong trachea, which throws off a posterior fork before the anal angle; the anterior fork running to the outer margin. Comparison of the bee with the saw-fly will show that the large anterior branch of the cubital trachea in the saw-fly does not belong to Cu. (It is of course, M).

As there is no branch arising from Cu near its base I assume that 1st A (or Cu_3, Cu_2 of Neuropterists) is lost. It is very possibly represented by the first cross-vein running from Cu to 2nd A in *Pamphilius* and a few Siricidæ, which is commonly considered to be Cu_2. (See "The Wings of Insects," Plate X, and Fig. 382).

The *second* and *third anals* are obvious if interpreted according to their tracheæ. Each is bifid, as in the Coleoptera, Neuroptera and Trichoptera, and like 3d A of the Lepidoptera. The recurrent character of the lower branch of 3d A reappears in some of the jugate Lepidoptera. 4th A exists as a rudiment in the jugum, as in the Lepidoptera; and more plainly in *Macroxyela* (Fig. 6).

The hind wing would be interpreted on the same lines. There are only two veins to represent C, Sc and R. I assume that Sc is atrophied, as a short stump is preserved in some species. In *Pamphilius* and some related forms Sc is normal. R is once forked. The most logical guess is that the anterior branch is R_1, since it shares in the thickened margin of the wing, like R_1 of the fore wing; then the other is R_{4+5}. The medial trachea arises from Cu, as on the fore wing, but more obviously, as there are no tracheæ in the cross-veins connecting it to R. Cu is simple, unless the apparent cross-vein connecting the outer part of Cu with 2d A is really Cu_2; in any case there is no tracheal evidence. In the anal region 1st A is lost, and 2d A and 3d A are simple; 4th A starts out as a transverse stem from the root of 3d A and then forks, one branch running out in the membrane of the jugal lobe, and the other directly across to the dorsal margin, exactly as in *Cupes* and a few Coleoptera near *Dascillus*. *Macroxyela* shows the arrangement in a still more primitive form. In the majority of Siricidæ 2d A and 3d A become coincident at the margin.

The only other forms besides the Siricidæ that are known to have a fairly complete tracheation are some of the bees. Figure 3 shows a pupal tracheation of a species of *Ceratina* (from Prof. O. A. Johannsen). It is on the whole much more specialized than *Tremex*, but more primitive in one significant point. The stem of M, although it rises out of the main stem of R, runs through the membrane to reach the part of the vein which is preserved, and so suggests that the small angulation in the first apparent cross vein between M and Cu (most plainly shown in *Paratiphia*, Fig. 11) is really the mark of the place

where M formerly attached. The point is indicated by an arrow in the drawings of venations. Another interesting point is that while the tracheation is somewhat broken up, and some tracheæ run in the membrane, the apparent cross-vein between R_1 and R_{4+5} is still supplied with a strong branch-trachea, R_{2+3}. The base of R_{4+5} has disappeared in the tracheation, just as in the venation.

Perhaps a warning should be given that the preceding account of the homologies of the veins is tentative as well as incomplete, and most likely not entirely accurate. It is intended as a stimulus to further morphological work on the hymenopterous venation, and not as a basis for systematic nomenclature.

In particular it is my hope to attract general attention to the need of more knowledge of the Hymenopterous tracheation, and set people on the watch for forms which show a significant development of pupal tracheæ. There are also possibilities in the imago of those forms where the veins are not too black.

It will be noted that the main trunks of the veins are as in the Comstock-Needham system, the difference in the anals being rather of nomenclature than of homology, for the purpose of bringing the order into line with the Lepidoptera and Coleoptera.

Notes on Individual Forms.

Tremex, *Xeris*, (Figs. 1, 2). The nygmata are shown in the figure of *Xeris*; the one in cell Cu is present in no other group of Hymenoptera, although it is one of those represented in the Panorpids. M is nearly straight and Cu is straighter than usual; the appendiculate cell is well developed, larger than in any other form known to me, though its bounding veins are not heavily chitinized; Sc is preserved, though it has generally been overlooked, and this is the group in which the recurrent branch of 3d A is best preserved. Altogether we have a primitive form which I cannot derive from any of the higher sawflies (none of which have preserved any tracheation); and I think the Siricidæ should have a more isolated position than they now hold. The remainder of the sawflies, so far as the characters here discussed go, could be derived from a Xyelid type.

The anal region is strongly reduced, but not always so much as in *Xeris*, which I chose because it represents the same stage of reduction as the tracheation figured.

The most ancient of fossil Hymenoptera (the Mesozoic *Protosiricidæ*) are closely related to the Siricidæ, but already much more specialized in the reduction of the transverse veins in the outer part of the wing. I have not been able to see specimens, and the published figures are not evidently wholly safe, the best one being unlike on the two sides of the same specimen, and all being incomplete. Some of the figures seem to show a complete media extending to the base of the wing, but it is not represented alike in different figures, and I suspect that a fold has been mistaken for a vein. I believe the family is intermediate between the Siricidæ and the Oryssidæ.

Macroxyela (Fig. 6). This represents the lowest form which may be called a normal saw-fly. Nygmata are present in cells M_2, 1st R_5, and 2nd A. In the higher forms they gradually disappear, the one in 1st R_5 being most persistent, and the only one present on the hind wing.

This is the only family that has preserved the tip of R_{2+3}, its oblique direction strongly suggesting that it is really a longitudinal vein, though tracheal evidence fails. The primitive features of this family are well known, but I should consider the zigzag course of the outer part of Cu to be a secondary effect of bracing for the support of the hind wing, rather than primitive. The anal region of the fore wing has lost 3d A_2, but the hind wing is more generalized than in any other Hymenopter. This is one of the very few forms in which the vein I have tentatively called 1st r-m is oblique down and out. This is ordinarily considered to show that it is really a portion of M, but I am inclined to consider that a sector of M has atrophied, otherwise it is hard to explain the distinct scar in *Paratiphia*, and the extremely persistent inwardly oblique direction of the vein in forms that in all other ways are not at all related. The atrophy of a sector of M is also normal in the related orders.

Xiphydria (Fig. 9). Here again 1st r-m is oblique out and down; as the family doubtless is directly related to the Xyelidæ this is not wholly surprising. The interpretation is otherwise straight-forward and the peculiar modification of Sc is well known. With the disappearance of cu-a, Cu straightens out again.

Blasticotoma (Fig. 8). The principal modification is the loss of 2d r-m, reducing the cells in this part of the wing to the same number as in the higher Hymenoptera, but in a different way. *Megalodontes* is similar, and in both we again get the vein 1st r-m oblique *down and in*, as in the Siricidæ and Clistogastra.

Tenthredo (Fig. 7). Here 1st r-m is obliterated and there is no way to decide which way it may have slanted, save by comparison with other families. Occasionally additional nygmata are preserved, in the Xyelid position.

Cephus pygmæus (Fig. 10). A most characteristic feature of this family is the single nygma in cell 1st R_5, located in the posterobasal angle, and the convergence of the medial system of wing-folds at the same point.

Paratiphia (Fig. 11). This form is unique in showing the base of R_{4+5} at the very stage of obliteration by the wing-fold, and shows plainly how the clistogastrous type arose from the more primitive. The stump of M is plainly marked, and 1st r-m therefore appears more clearly as a cross-vein than in any other form. Sc is also visible, forming a loop at the base, much like that in *Tremex* and *Xyela*.

COMPARISON OF THE PRESENT SCHEME WITH THE COMSTOCK-NEEDHAM NOMENCLATURE.

Veins		*Cells*	
Comstock-Needham	Forbes	Comstock-Needham	Forbes
C	C	C	C
Sc	Sc	Sc	Sc
R_+M	R (in part R_+M)	R	2d R
Cu	Cu	M	1st R+M
1st A—2d A	2d A	Cu	1st A
3d A	3d A	1st A	2d A_1
*	4th A	2d A	2d A
Sc_1	Sc_1	3d A	3d A (+3d A_1)
Sc_2	Sc_2	Sc_1	Sc_1
R_1	R_1	st (Sc_2)	st (Sc_2)
Rs	R_{4+5} (1st sector)	1st R_1	1st R_3
r	R_{2+3} (1st sector)	2d R_1	R_1
R_2	R_{2+3} (2d sector)	R_2	2d R_3 (?)
R_3	c. v. (Tremex) R_{4+5} (Xyela)	R_3	(3d R_{2+}) 3d R_4
M (1st sector)	1st r-m	R_4	2d R
r-m	2d r-m	R_5	1st R_5
R_5	3d r-m	M_4	2d M
R_4	4th r-m	1st M_2	3d M
M, M_{1+2}, $M_{1+}R_{4+5}$	M	M_1	4th M
m-cu	m-cu&M (?)	Cu_1	Cu
M_{3+4}	2d m-cu	M_2	Cu_2
M_2 (1st sector)	3d m-cu	2d M_2	Cu_1
Cu, Cu_1, M_4, M_2 (1st sector)	Cu		
m, M_2	Cu_1		
Cu_2	1st A		
$Cu_{1+}M_4$	cu-a		
M_2 (2d sector)	Cu_2		
(Cu-) 1st A	(1st A-) 2d A_1		
2d A	2d A_2		
3d A (2d sector)	3d A_1		
*	3d A_2		

* Figured but not labelled.

Postscript: While this article was in press Tillyard (Am. Journ. Sci. (5) viii, 111, 1924) has published a closely similar interpretation of the Hymenopterous venation, based on a Mesozoic type. I cannot believe that this fossil, which is extremely specialized on both the costal and inner margins, is at all closely related to the ancestor of the Hymenoptera. However it could be brought in line with the present interpretation by assuming that the stems of R_{4+5} and M have fused, and reading R_4 and R_5 in place of M_1 and M_2. On the other hand it is possible that M_{1+2} has been fused in with terminal branches of R in the Hymenoptera, as Tillyard supposes, though there is no tracheal evidence of it.

EXPLANATION OF FIGURES.*

Plate I.

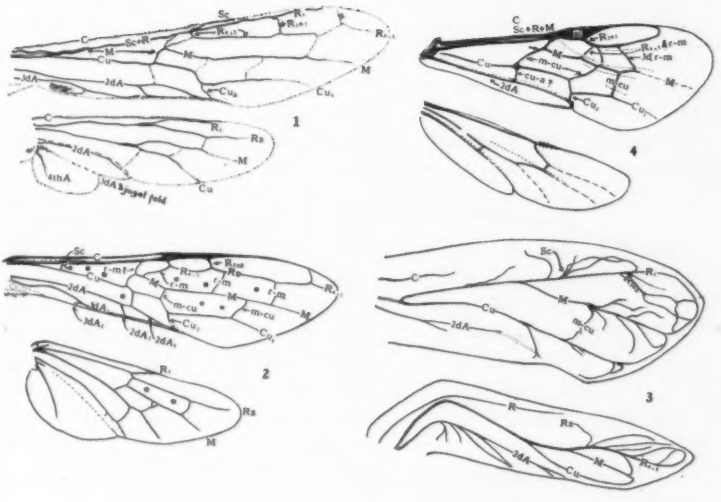
Fig. 1. *Tremex fuscicornis* F. Imaginal tracheae in solid lines, veins dotted.
Fig. 2. *Xeris.* Venation.
Fig. 3. *Ceratina dupla.* Tracheation of early pupa.
Fig. 4. *Ceratina cucurbitana.* Venation.

Plate II.

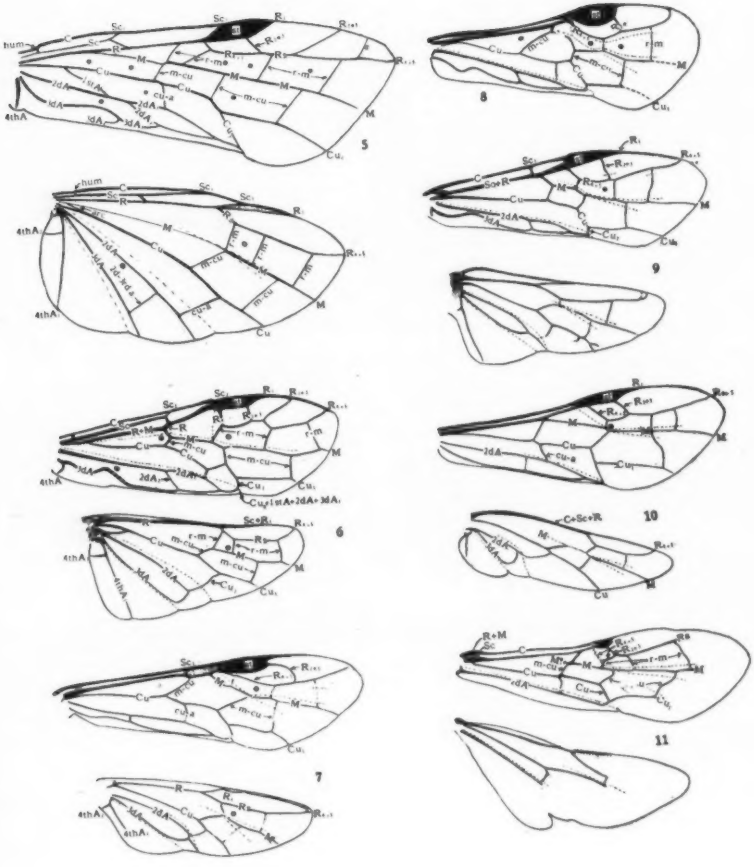
Fig. 5. Hypothetical plan of Hymenopterous venation.
Fig. 6. *Macroxyela infuscata* (Xyelidae). Venation.
Fig. 7. *Tenthredo dispar* (Tenthredinidæ). Venation.
Fig. 8. *Blasticotoma filiceti* (Blasticotomidæ). Venation of fore wing.
Fig. 9. *Xiphydria tibialis* (Xiphydriidæ). Venation.
Fig. 10. *Cephus pygmæus* (Cephidæ). Venation.
Fig. 11. *Paratiphia albilabris* (Tiphiidæ). Venation.

---

*All but Figures 3 and 5 are drawn by projection from slides in the collection of Cornell University.



Wm. T. M. Forbes



Wm. T. M. Forbes

THE BEHAVIOR OF THE LARVAE OF COTINIS NITIDA BURMEISTER. (COLEOPTERA)

ANNA LAURA HINTZE
Zoology Department, University of Wisconsin

The larvæ of *Cotinis nitida* Burmeister, the green June beetle or fig-eater, is easily distinguished from other grubs by its peculiar habit of creeping upon its dorsal surface. It makes burrows which often open to the surface. Davis*, working in Illinois, found that grubs of this species came to the entrances of their burrows or even crawled upon the surface of ground when the soil was covered with water.

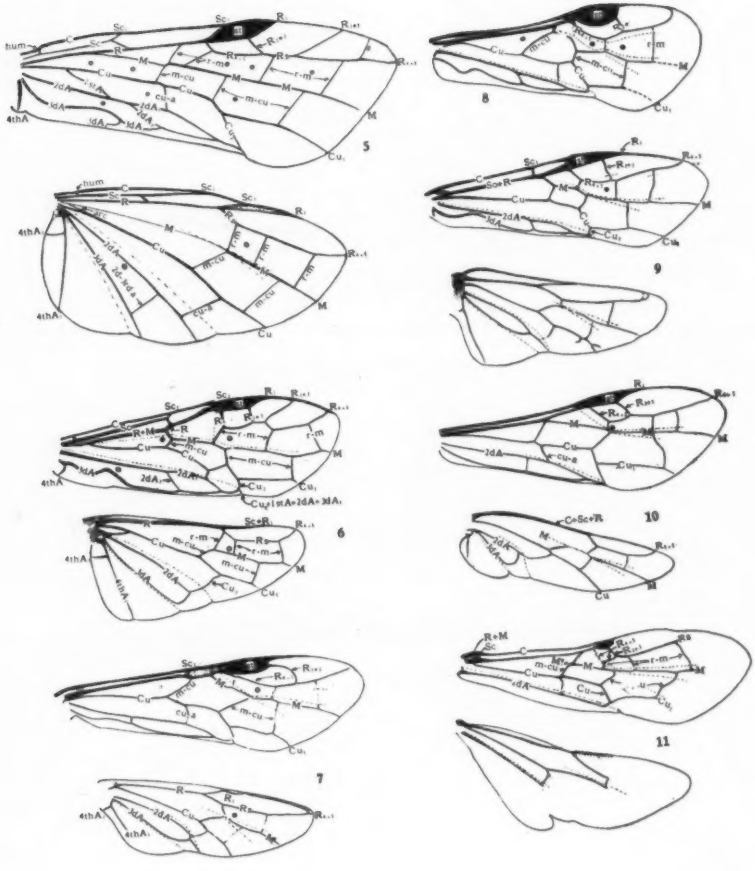
In the fall of 1923, after a rainy late summer in the region of St. Louis, Missouri, the writer observed that burrows of Cotinis nitida were numerous in lawns and gardens, the surface casting looking like ant hills to the casual observer. At night the grubs wandered about and many were found in the morning in cellar entrances and catch basins.

Approximately three hundred were sent to Madison, Wisconsin for study at the University of Wisconsin. They were kept in galvanized iron boxes and proved to be very hardy. They grew somewhat, pupated, and later emerged as imagoes. Eggs were laid and some hatched into young larvæ, the behavior of which was like that of the well grown larvæ collected in the South. Experiments showed that the grubs preferred foods in the following order: sweet potatoes, Irish potatoes (if the skin was broken) turnips, and carrots. They showed a preference for a high soil temperature. Out of thirty grubs tested, twenty-four gathered where the soil temperature was 40° C.; three at 39°, and three at 32°; none at 24° and 22°.

LOCOMOTION.

The locomotion of *Cotinis* larvæ is extremely peculiar. A grub moves along rapidly on its dorsal surface by waves of contraction, its legs waving uselessly in air. If one turned over on its ventral surface, it brings its anterior and posterior ends together, falls over on its side, and then rolls back onto its dorsal surface. *Cotinis* larvæ move underground in much the same way as on the surface. Apparently the only

* U. S. Dept. Agr., Farmer's Bulletin No. 940. 1922.



Wm. T. M. Forbes

THE BEHAVIOR OF THE LARVAE OF COTINIS NITIDA BURMEISTER. (COLEOPTERA)

ANNA LAURA HINTZE
Zoology Department, University of Wisconsin

The larvæ of *Cotinis nitida* Burmeister, the green June beetle or fig-eater, is easily distinguished from other grubs by its peculiar habit of creeping upon its dorsal surface. It makes burrows which often open to the surface. Davis*, working in Illinois, found that grubs of this species came to the entrances of their burrows or even crawled upon the surface of ground when the soil was covered with water.

In the fall of 1923, after a rainy late summer in the region of St. Louis, Missouri, the writer observed that burrows of Cotinis nitida were numerous in lawns and gardens, the surface casting looking like ant hills to the casual observer. At night the grubs wandered about and many were found in the morning in cellar entrances and catch basins.

Approximately three hundred were sent to Madison, Wisconsin for study at the University of Wisconsin. They were kept in galvanized iron boxes and proved to be very hardy. They grew somewhat, pupated, and later emerged as imagoes. Eggs were laid and some hatched into young larvæ, the behavior of which was like that of the well grown larvæ collected in the South. Experiments showed that the grubs preferred foods in the following order: sweet potatoes, Irish potatoes (if the skin was broken) turnips, and carrots. They showed a preference for a high soil temperature. Out of thirty grubs tested, twenty-four gathered where the soil temperature was 40° C.; three at 39°, and three at 32°; none at 24° and 22°.

LOCOMOTION.

The locomotion of *Cotinis* larvæ is extremely peculiar. A grub moves along rapidly on its dorsal surface by waves of contraction, its legs waving uselessly in air. If one turned over on its ventral surface, it brings its anterior and posterior ends together, falls over on its side, and then rolls back onto its dorsal surface. *Cotinis* larvæ move underground in much the same way as on the surface. Apparently the only

* U. S. Dept. Agr., Farmer's Bulletin No. 940. 1922.

use ever made of the legs is as an aid to the mandibles in digging and to throw the earth backward over the ventral surface. In the burrows a larva moved by energetic jerks aided by the numerous ventral bristles, which push upon the upper wall of the burrow. Except when wandering it is positively thigmotropic.

Rate of Locomotion.

To determine the rate of locomotion on a smooth surface, grubs were observed singly. They were placed on a concrete floor and trailed with a pencil. Then the length of the line was measured with a map measurer. The rate of locomotion varied greatly. For ten grubs kept at room temperature (20° C.) for two hours before being tested, the lowest rate was 30.3 cm. per minute; the highest 63 cm. and the average, 49.87 cm. Tests made at different temperatures showed little difference in rate.

Grubs to be tested for rate of locomotion in soil were placed singly in a shallow metal dish filled to a depth of three centimeters with loose soil. The soil was deep enough to cover the grubs after they had burrowed, but shallow enough so that as they progressed a ridge was uplifted. This ridge was somewhat circuitous and was measured by means of a string placed along it. The slowest grub moved at the rate of 1.43 cm. per minute, the fastest at 3.7 cm. per minute. The actual rate when moving was greater than this average indicates, for locomotion was not continuous.

Factors Influencing Locomotion.

The writer's observations showed that grubs continually came out on the surface of soil of average water content. Tests were made to determine the effect of varying water content upon emergence. Oven-dried soil was used, and water added by weight to give a water content of zero, ten, twenty, thirty, and forty percent. The twenty percent soil was of average water content; the forty percent was saturated. Five grubs were used for tests in each percentage. In the late afternoon the grubs were put upon the soil in crystallization dishes. All the grubs soon burrowed except those on dry soil. Those in saturated soil soon came out again. Those that had burrowed in the other dishes emerged during the night. It was believed that the presence or absence of food in soil might be of more importance than the moisture content, and tests were accordingly made like those just described, but with food in the dishes. All the grubs emerged from the dry soil, two from the ten per cent, and none from the twenty percent soil. In the last case the soil was disturbed and openings had been made to the surface. A subsequent experiment showed that soil disturbance might result from underground movements as well as from locomotion above ground.

In another test soil of twenty per cent water content was used and a wheat and corn seedling were supplied in addition to root food, with the idea that perhaps grubs might emerge from the soil to seek a green food. One grub was placed in each of five finger bowls arranged in a group and

food put upon the surface. The next morning one of these five bowls contained three grubs in place of the original one. The presence of food has not prevented wandering.

Effect of Light on Locomotion and Activity.

To determine whether grubs emerged on account of the presence or absence of light three crystallization dishes (each containing soil of twenty per cent water content, five grubs, and a supply of food) were placed on a box thirty-eight centimeters below a 60-watt mazda bulb in a room which maintained a nearly constant temperature at 27° C. Enough space was allowed above the soil for locomotion. Each dish was protected from heat radiation from the lamp by a water screen set on wooden pegs above it. The light burned continuously for twenty-four hours, but did not prevent emergence from the soil, for the next morning there were deep smooth grooves around the edges of the dish, where the grubs had been moving.

The frequency of emergence among grubs in the light was compared with those kept in the dark. Similar groups of grubs were observed throughout an entire night. Each group consisted of ten grubs, each individual being in a finger bowl of soil of twenty per cent water content containing a piece of sweet potato and a corn seedling. The group in the light was kept under constant observation from 6 p. m. until 5 a. m. The dark group was examined every half hour. In the light three grubs came out repeatedly. There was much movement under the soil in other dishes and as a result the soil caved in in several places. Activity was greatest from 12 to 2 a. m. In the dark one grub left its dish repeatedly, three crawled about on the surface of the soil, and one made an opening to the surface but did not emerge.

These observations indicated a rhythmic emergence. To determine how long this rhythm would persist under constant conditions, one grub was put into each of ten battery jars about one-third full of loose soil of average (20 per cent) water content and a supply of food. All of the jars were placed on the box under the electric light and it was kept burning day and night. Observations were made daily. At first emergences were frequent. Every individual came upon the surface on at least one night during the first few days; most of them oftener. Later the number of emergences decreased because of pupation. The first grub to pupate emerged only once, and another, which pupated five days later came out only twice. In every case pupation was preceded by a period of inactivity during which the grub became smaller. Three grubs came out repeatedly to the end of the test, which ran three weeks.

Letisimulation.

Cotinis larvæ letisimulate for a short time when they are stimulated by a touch, by a slight jar such as that made by scratching with a pencil when following their paths, or when they are handled or dropped. If stimulation occurs while a grub is in motion, it remains fully extended, but if handling or dropping brings about the death feint, it lies curled up on its side. Repeated stimulation causes repeated letisimulation.

Resistance to Submergence in Water.

The recovery of two grubs found apparently lifeless in some water into which they had fallen led to a test of the resistance of grubs to complete submergence. Individuals to be tested were placed in tap water which had a temperature of 5° C. when drawn. When dropped into the water the grubs sank, carrying air bubbles on their hairs. The bubbles later disappeared. At first the period of submergence was lengthened by half hours, then by hours, and later by longer periods. All grubs submerged for periods up to and including forty-eight hours recovered except one submerged nine and a half hours. Four were submerged sixty-five hours. Of these one recovered but died soon afterward. The grubs submerged for three or four hours recovered in less than twenty minutes. As the period of submergence increased the time required for recovery increased. The individuals submerged forty-eight hours were at first left as dead, but were found to be alive several hours later. Those submerged for short periods were limp when taken out, but those submerged longer came out stiff and rigid.

SUMMARY.

1. *Cotinis nitida* grubs will feed on root vegetables in the following order: sweet potato, Irish potato (after the skin is broken), turnip, carrot.

2. They prefer a rather high soil temperature 39° to 40° C.

3. Their rate of locomotion both on surfaces and beneath the soil is remarkably rapid, the average being 49.87 cm. per minute on a surface and 2.42 cm. per minute underground.

4. They letisimulate if touched or jarred while moving.

5. Emergence from the soil does not depend primarily upon water content, or temperature changes, or upon the absence of food or light, but is a rhythmical phenomenon and usually takes place at night.

THE OCCURRENCE OF MITES IN THE TRACHEAL SYSTEM OF CERTAIN ORTHOPTERA

LAWRENCE PAUL WEHRLE, Cornell University,
and
PAUL S. WELCH, University of Michigan

The initial discovery of this form of parasitism was made on August 13, 1914, by Mr. C. C. Hamilton, a student at the Kansas State Agricultural College. While examining a series of insects for internal parasites he found the tracheæ of a grasshopper (*Hippiscus apiculatus* Harris) infested with what appeared to be a mite. The unusualness of such a relation attracted attention at once and the problem of making an intensive study of the whole matter was turned over to the first author of this paper, then a graduate student in the Department of Entomology in the above mentioned institution and working under the direction of the second author. The study was carried on over two successive seasons, but later interrupted by the departure of both authors to other institutions. In the meantime Rennie and his associates (1921) announced the discovery in Great Britain of a new species of mite, *Tarsonemus woodi* Rennie, now known as *Acarapis woodi* Rennie, which inhabits the tracheal system of the common honeybee and which, according to all evidence available at the present time, is the causative agent of the well known Isle of Wight disease. This appears to be the first published record of mites inhabiting the tracheal system of an insect. The discovery of this unique form of parasitism and its causal relation to the Isle of Wight disease gave new interest to the earlier discovery of mites in the tracheal system of grasshoppers and during the past six months a complete re-examination of all of the original materials and records has been made. Although very incomplete in certain respects, it has seemed wise to publish an account of the principal results of this investigation in order to make available such facts as have been determined and to interest other investigators in extending knowledge of this form of parasitism.

The writers wish to acknowledge their indebtedness to Dr. H. E. Ewing for the identification of the parasite and for certain

information concerning its structural features and its relationships, and to Dr. L. O. Howard for first calling the attention of the writers to the European work on *Acarapis woodi*. Mention is also due the Department of Entomology, Kansas State Agricultural College, since most of the work was done there.

FIELD STUDIES.

After the initial discovery of this form of parasitism collections and examinations of grasshoppers were made from the same general locality throughout the months of October and November, 1914, and at intervals of about a week throughout the spring, summer and autumn of 1915. The collections covered the territory east, north, and west of Manhattan, Kansas, within a radius of approximately two miles, special attention being given to the grass lands. During that time more than four hundred specimens of grasshoppers were examined. These included about two hundred and fifty specimens of *Hippiscus apiculatus* (Harris), more than fifty specimens of *Melanoplus bivittatus* (Say), many specimens of *Dissosteira carolina* (Linn.), a few specimens of *Arphia carinata* Scudder, sometimes regarded as a form of *xanthoptera* (Burmeister), and a large number of other grasshoppers of varying degrees of maturity which were given rapid examination for mite infection without stopping to make specific identifications.

Species Infested.—Of the total number examined, twenty individuals were found to contain the mites, of which nineteen were *Hippiscus apiculatus* and one *Arphia carinata*. The ratio of the number of parasitized individuals to the total number examined probably has no particular significance since, among other things, the evidence available suggests that there is some sort of seasonal relation involved, as will be mentioned below. Furthermore, the apparent rarity of this parasitism in *Arphia carinata* may possibly be due to the fact that this grasshopper was not a common species in the collecting grounds, at least during the time covered by these collections.

It is interesting to note that all parasitized individuals collected were adult females, although nymphs and adults of both sexes were examined. Whether this is really a constant feature remains to be determined. The possible significance of these data will be mentioned in connection with the discussion of the method of infestation.

Seasonal Distribution of Parasitism.—During the season of 1914 parasitized grasshoppers were found from August 13 to November 11, while in 1915 they appeared from July 18 to August 15. It is likely that the failure to find them after August 15 in 1915 was really a matter of collecting and not an actual absence, although collections were carried on regularly until October 24. The one infested specimen of *Arphia carinata* was taken on November 11, 1914. As previously mentioned, the mites, for some unknown reason, seem to infest only the adults. In *Hippiscus apiculatus*, as is well known, the winter is passed in the nymph stage. The adults of this species first appeared in the collecting grounds about May 1, in 1915, although they were taken as late as June 2. The failure to find infested individuals after November 11, in 1914, was doubtless due to the normal disappearance of the adult generation.

Other Localities.—Examinations of various species of grasshoppers collected in the vicinity of Ann Arbor, Michigan, and Ithaca, New York, have thus far yielded no mite infested individuals. Rennie (1921, p. 778), states that he and his associates examined numbers of insects representing several orders, but found no tracheal infestation. However, no grasshoppers were mentioned in his list.

THE PARASITE.

Identification.—Recently a considerable number of these mites and their eggs were submitted for identification to Dr. H. E. Ewing, who finds that they represent a new genus and a new species belonging to the family Tarsonemidæ, and that they resemble somewhat the species which is said to produce Isle of Wight disease, although quite distinct in certain morphological respects. A formal description of this new genus and species will appear in the near future.*

Structural Features and Peculiarities.—Certain structural peculiarities appear in the adult mites, one of which is the complete loss in both sexes of the fourth pair of legs, a feature which puzzled the authors of this paper greatly in the initial stages of the study and which continued to be a matter of

* Subsequent to the presentation of this paper for publication Dr. Ewing has described this mite (1924, Proc. Ent. Soc. Wash., 26:67-68) under the name *Locustacarus trachealis*.

uncertainty until interpreted by Dr. Ewing. In the mite producing the Isle of Wight disease the fourth pair of legs is present, although much reduced in size (Rennie, 1921, p. 771, Fig. 2, *a* and *b*). Dr. Ewing has granted the writers permission to state (1) that he is studying, at the time of this writing, another Tarsonemid mite, closely related to the one discussed in this paper, which occurs under the elytra of a large Central American beetle, the female of which has lost both the *third* and the *fourth pair of legs*; (2) that a similar loss of the last two pairs of legs in the female has already been reported by Berlese in two different instances, a new species of mite, *Podapolipus grassi*, from the exterior of an acridid grasshopper taken at Salerno, Italy, and another new species of the same genus, *Podapolipus bacillus*, from the wings of an acridid grasshopper collected in Java; and (3) that the gravid females of this Central American form are very similar to those of the grasshopper Tarsonemid, but so far as is known it never enters the tracheæ of its host. Apparently the grasshopper mite from Kansas is intermediate between *Acarapis woodi* and the above mentioned species in the matter of reduction of legs. Dr. Ewing has also informed the writers that the grasshopper Tarsonemid agrees with the Isle of Wight disease mite in that the females have lost the pseudostigmatic organs (club-shaped sensory structures between the first and second pairs of legs), these two species being unique in this respect for the whole family to which they belong. The gravid females of the grasshopper mite are greatly swollen in the middle region of the body so that the two anterior pairs of legs are widely separated from the posterior pair. Distension in the well known *Pediculoides* occurs more posteriorly and in such a way as to leave all of the legs close together.

RELATION TO THE HOST.

Distribution in Host.—In cases of relatively heavy infestation, the mites and their eggs may occur widely through the tracheal system of the host. Many of the hosts showed a concentration of the parasites in the region adjacent to the mesothoracic and metathoracic spiracles and in the first two or three abdominal segments. The air sacs of the thorax and those of the first three abdominal segments are the principal ones concerned, although the infestation may extend to those in the

fourth abdominal segment and forward into the head, but to a diminished degree. All of the larger tracheæ from the head to the sixth abdominal segment may contain eggs or mites or both. It was obvious that size relations of the smaller tracheæ and the mites constituted a barrier to dissemination into the finer tubes. The distribution of this mite in the grasshopper is apparently a much more extensive one than is that of *Acarapis woodi* in the honeybee, since it has been stated by White (1921, p. 755) that the latter is consistently present in the thorax and occasionally in the air vessels of the head, but never in the abdomen.

Degree of Infestation.—Infestation was found to be quite variable. Gradations from a minimum of one mite and a small number of eggs per host to a host whose tracheæ and air sacs yielded dozens of mites and hundreds of eggs occurred. Not infrequently the air sacs and larger tracheal passages in the thorax and first three abdominal segments were almost or completely filled with mites and their eggs. So heavy may the infestation be that it is a conspicuous phenomenon when the haemocoele of the host is opened since the mites and eggs form a yellowish mass which shows through the semi-transparent walls of the sacs and tubes.

Effect on the Host.—The effect on the host seems to be strikingly similar to that of *Acarapis woodi* on the honeybee in the production of Isle of Wight disease. It appears from such evidence as we have been able to secure that there is probably a two-fold effect, (1) the mechanical obstruction of some of the important air passages with consequent partial or complete stoppage of air circulation; and (2) the effect resulting from the feeding activities of the mites.

In heavily infested hosts the air sacs and many of the principal tracheæ may be so filled with masses of mites and eggs that serious interference with normal aeration of the tissues which depend upon the obstructed tracheæ must of necessity result, especially in the region of the thorax and the anterior portions of the abdomen. White (1921, pp. 760-761) has very properly pointed out that in mite infestations of the honeybee the seriousness of the mechanical effect does depend wholly upon the actual number of mites distributed throughout the tracheal system, but that three distinct conditions, namely, (a) degree of obstruction, (b) position of obstruction, and (c) whether obstruction is bilateral or unilateral, decide the extent

of the effect. These considerations are pointed out as explaining the "apparent vigour of many heavily infested bees." There is every reason to believe that these conditions also operate in mite infested grasshoppers. Early in the work on the grasshopper it was noted that in many infested individuals certain tissues adjacent to the regions of infestation tended to lose their normal appearance and become distinctly darker in color, possibly indicating pathological change. As to the exact cause of this discoloration, nothing can be stated at this time. However, it might be mentioned that visible pathological changes have been described as a result of the Isle of Wight disease mite which involve primarily the muscular system of the thorax, the color of the infested tracheæ, and parts of the alimentary system. In an attempt to secure information as to the effects of mechanical obstruction of the air tubes, White (1921, pp. 761-762) performed experiments on healthy bees by sealing one or both of the first thoracic spiracles with paraffin wax with the general result that morphological and physiological effects closely simulating those characteristics of the Isle of Wight disease were produced.

Evidence secured during this work on the grasshopper indicates that this mite probably obtains nourishment by piercing the walls of the tracheæ and air sacs with the mouth parts and sucking the blood of the host. Mites were found so firmly attached at the mouth region to the walls of the air passages that considerable force was required to dislodge them. How serious this probable form of feeding is remains uncertain, but it was definitely observed that discoloration areas surround the region of the attachment, which suggests some sort of pathological change in the walls of the tracheæ and recalls the similar effect reported in honeybees afflicted with Isle of Wight disease.

White (1921, p. 762) postulated a toxic substance produced by *Acarapis woodi* and injected through the puncture made by the piercing apparatus. The writers refrain from expressing any opinion as to the possible presence of such a factor in the effect of the grasshopper mite. Some of the infested grasshoppers exhibited a low degree of activity which may possibly have been due to some of the internal effects of the parasite.

Two specimens of *Hippiscus apiculatus* found dead in the field contained living mites. One or two living specimens of

the same insect brought into the laboratory died before they could be examined for parasites. In these cases the host had been dead for several hours previous to the examination, but the tracheal system contained living mites. Evidently this parasite can live for at least some hours after the death of the host.

LIFE HISTORY STAGES.

In the early stages of this work much time was devoted to an attempt to solve the relations of the various stages often found in the same host. Perplexity over the failure to find stages with four pairs of legs led to repeated examinations and re-examinations of both hosts and parasites, but only individuals with three pairs of legs were found, although the writers were convinced that the eggs must be produced by the large distended individuals. These and other puzzling features have been cleared up by Dr. Ewing's study of the materials submitted to him. Dr. Ewing has found that the species apparently has but three stages, namely, the egg, the adult male and the adult female; that both male and female have but three pairs of legs; that females are present in various states of distension and ovulation; that nongravid females agree in all respects with the final stage in the developing egg; and that the evidence suggests the possibility of two supernumerary embryonic stages, known as *deutovum* and *tritovum*, respectively, homologous in this group of mites with the larvæ and nymphal instars of most other mites. The *deutovum* occurs widely among certain arthropods, but the *tritovum* is a rarity. The gravid females frequently contain six to eight full sized eggs and many more in various stages of development, differing in this respect from the female of *Acarapis woodi*, which never contains a large number of eggs at one time.

All of these life history stages may be found in the tracheal system of a single host and the indications are strong that this mite is able to pass its entire life cycle in this situation and to reproduce and develop without leaving the host. No information was secured as to the length of the different stages or the time required to complete a generation. The eggs, as they appear in the body of the host, are oval, smooth, and pearly white in appearance. Measurements of twenty-five eggs taken at random from alcoholic material and involving more than

one host yielded the following data: Length, 0.140-0.169 mm., average, 0.156 mm.; transverse diameter, 0.092-0.118 mm., average 0.106 mm.

METHOD OF INFESTATION.

No evidence was secured as to the method of infestation. These mites were never found on the exterior of the host. However, it is difficult, in the light of such facts as are available, to conceive the entrance of the mite into the host in any way other than through the spiracles of the thorax or abdomen or both. From the very nature of the general circumstances it seems obvious that some stage of this mite must pass from the host into the outside world if it is to persist in the next generation of hosts. There seems to be no intrinstic reason why adult mites could not pass through the larger spiracles of the two species of grasshoppers involved, should they make an effort to do so. The tendency for the greatest concentrations of the parasite to occur in the thorax and first two or three abdominal segments might lead to the suspicion that ingress was effected through the large spiracles in those regions of the body. The apparent restriction of the parasite to the two species of grasshopper in the midst of other equally abundant species, the apparent restriction to the adult stage, the apparent restriction to the female sex, and the condition and whereabouts of the mite during the winter and spring, bring up a large number of questions unanswerable at this time. Both male and female mites are capable of some locomotion and it is thinkable that they might crawl out through the spiracles of one grasshopper and onto another, although it would seem as if the chances of passing into another host would be definitely restricted since the grasshoppers are not regularly concentrated into close quarters as are honeybees in the hives.

If, contrary to the data of the writers, the nymphs of *Hippiscus apiculatus* should be subject to infestation, it would be interesting to speculate as to the probable effect on the parasites of ecdysis with its accompanying shedding out of the intima of tracheæ. Whether this is a vague suggestion of a reason for adult host infestation only, nothing can be said at present.

It is a well known fact that the female of *Hippiscus apiculatus* lacks much of the activity of the male and seldom takes to

wing, depending more frequently upon concealment for escape from enemies. It is thinkable that the more sluggish habits accompanied by a tendency to remain on the ground in close contact with vegetation, offer a vague suggestion as to the prevalence of the parasites in the females, but such suggestion involves the assumption that the parasites may, at least for a brief time, be present in the environment apart from another host. Furthermore these circumstances also would not prevent the occasional infestation of a male.

Phillips (1923, pp. 3-4), has summarized the various speculations as to the origin of the parasitic habit manifested in the Isle of Wight disease mite and comments here are unnecessary except possibly to mention the obvious bearing of these speculations upon the grasshopper mite.

DISCUSSION.

It does not seem unreasonable to suspect that other instances of mites inhabiting the tracheal systems of insects exist and it is to be hoped that the work herein presented, incomplete as it is, will serve to interest investigators in more extended searches along this line. Possibly tracheates other than insects may be worthy of examination in this connection. So far as can be determined at present there is no interrelation between the Isle of Wight disease and the parasitism in the grasshopper. The mites concerned represent two different genera and the writers have not been able to discover anything in the field conditions from which the infested grasshoppers were taken to indicate that this mite is anything but a native species. Some striking similarities between the two mites and their relations to the hosts appear and critical studies on any American species which may be discovered might throw important light upon some of the problems of the Isle of Wight disease.

SUMMARY.

1. A Tarsonemid mite representing a new genus and a new species has been found inhabiting normally the tracheal system of the grasshoppers, *Hippiscus apiculatus* (Harris) and *Arphia carinata* Scud. A similar phenomenon was first reported from Great Britain in the honeybee and is now regarded as the cause of the Isle of Wight disease. This paper constitutes the second published record of such a unique form of parasitism.

2. Only adult females of these grasshoppers were found to be infested.

3. Structurally this mite resembles the species which produces the Isle of Wight disease.

4. Complete loss of the fourth pair of legs in both sexes, loss of the pseudostigmatic organs in the female, and distension in the mid-body region of the gravid female resulting in the wide separation of the first two pairs of legs from the third pair, are among the principal structural peculiarities of this mite.

5. Mites and eggs may occur in the principal tracheæ and the air sacs of the head, thorax, and the first six abdominal segments, although the thorax and first three abdominal segments are the principal regions involved.

6. Infestation may be slight or it may be so severe that certain air sacs and tracheæ are almost or completely obstructed by masses of mites and eggs.

7. Mechanical obstruction and feeding punctures seem to be responsible for discoloration effects upon the certain tissues of the host.

8. According to Dr. H. E. Ewing, only three life history stages appear to exist, the egg, the male and the female. The nongravid female agrees in all respects with the final stage in the developing egg.

9. All stages of life history may be found in the same host.

10. The method of infestation is unknown. Possibly the mites enter through the large spiracles of the thorax or abdomen or both.

LITERATURE CITED

Phillips, E. F. 1923. The Occurrence of Diseases of Adult Bees, II. U. S. Department of Agriculture, Department Circular 287, 34 pp.

Rennie, J., White, P. B., and **Harvey, Elsie J.** 1921. Isle of Wight Disease in Hive Bees. (1) The Etiology of the Disease. Trans. Royal Soc. Edinburgh, 52: 737–754, 1 pl.

Rennie, J. 1921. Isle of Wight Disease in Hive Bees—Acarine Disease: The Organism associated with the Disease. Trans. Royal Soc. Edinburgh, 52: 768–779, 1 pl.

White, P. B. 1921. The Pathology of Isle of Wight Disease in Hive Bees. Trans. Royal Soc. Edinburgh, 52:755–764, 1 pl.

ARTIFICIAL FERTILIZATION OF AQUATIC INSECTS

A. H. WIEBE,
Bluffton College, Bluffton, Ohio

INTRODUCTION

In the following paragraphs are recorded a few attempts of artificial fertilization of several species of aquatic insects. Artificial fertilization as used in this paper does not mean the stimulating of the eggs with artificial, chemical or physical stimuli; it merely means the artificial mixing of the eggs and the sperm outside of the insect's body.

The experiments described here were carried out at the Ohio State University Lake Laboratory at Put-in-Bay, Ohio, during the summer of 1924. I wish to take this opportunity to thank Dr. C. H. Kennedy, of the Laboratory Staff, for suggesting this work and for aid received in the identification of specimens. Dr. P. W. Claassen, of Cornell University, was kind enough to identify the stoneflies that were sent to him.

Extensive experiments were carried out with the spotted mayfly, *Ephemera simulans* Walk; the Canadian soldier (mayfly) *Hexagenia bilineata* Say; the fish fly, *Sialis infumata* Newn; the large stone fly, *Acroneuria evoluta* Klapalek; and the large midge, *Chironomus plumosus* L.

METHOD.

As indicated in the introduction, artificial fertilization as used in this paper means the artificial mixing of the ova and spermatozoa outside of the insect's body. The mixing of the ova and sperms was carried out in the following media: (1) Normal physiological salt solution; (2) Two-thirds normal physiological salt solution; (3) One-third normal physiological salt solution; (4) Sterile lake water. In each case after the eggs had been treated with spermatazoa in one of the above media, they were incubated in sterile lake water, because all the insects used in these experiments with the exception of *Sialis infumata*, deposit their eggs on the water.

The reason for using different media was to determine whether the medium in which the eggs and sperms were mixed

would have any effect upon the process of fertilization. It is a well known fact that animal tissues in general retain their power of irritability longer when kept in a normal physiological salt solution. The physiological salt solution may, therefore, be taken to represent as nearly as possible the conditions as they exist in the insect's body. Then by modifying this solution—by diluting in this case—it would be possible to determine how far conditions could vary without making fertilization impossible.

The first step in the solution of the problem was the collecting of mature insects, and the separation of males and females to prevent mating. Since as a rule an insect is mature as soon as it has wings, it is easy to obtain mature individuals. In the case of the mayflies, however, special care has to be taken to avoid sub-imagos. This difficulty can be overcome by collecting the insects in the morning or early afternoon and then keeping them until evening or the next morning. By that time they have passed through the final moult and are ready for the experiment.

The next step is the removal of the ovaries and the testes. The ovaries can easily be removed under the low power of a binocular. The testes, however, are often so small that it is rather difficult to remove them alone, and the best thing, therefore, is to remove the entire abdominal contents. In this way one is always certain to get the testes. In the larger species of mayflies the removal of the eggs is especially easy; all that is necessary is to cut off the abdomen, immediately behind the thorax, and then force the eggs out by gently compressing the abdomen. It might be of interest to note that when a female mayfly is placed in tobacco extract, she extrudes her eggs. This observation was first made by Mr. Crosly, of Put-in-Bay, Ohio.

After a female has been selected for the experiment, the ovaries are removed as indicated above. Part of the ovarian contents is then placed on a slide in a few drops of one of the different media and mixed with the abdominal contents of the male. The latter material is teased to pieces with a pair of needles to insure the liberation of the spermatazoa. The eggs are stirred at intervals for thirty minutes to insure thorough mixing with the spermatazoa. At the end of thirty minutes the eggs are removed from the liquid in which they were mixed with the sperms and incubated in lake water. The remainder

of the ovarian contents is incubated in lake water without being mixed with spermatazoa. This serves as a check to detect females that might have been already fertilized.

Since *Sialis infumata* does not deposit its eggs in the water, but near the water, so that the young larvæ drop in the water, it was necessary to modify the process of incubation. So instead of placing the eggs—both those treated with sperms and those used as a check—in lake water, they were incubated in cheese cloth placed in dishes containing lake water. This provided a moist atmosphere without actually submerging the eggs in water.

RESULTS.

Although many trials were made with *Sialis infumata*, *Acroneuria evoluta* and *Chironomus plumosus*, no positive results were obtained. Likewise reciprocal crosses between *Hexagenia bilineata* and *Ephemera simulans* gave negative results.

Tables I and II give the results for *Ephemera simulans* and *Hexagenia bilineata* respectively.

TABLE I. EPHEMERA SIMULANS WALK.

Date of Incubation	Date Hatched	Period of Incubation	% Hatched	% Hatched In Check	Medium
6-26	7-4	8 days	75%	None	Normal salt solution
6-26	7-4	8 days	65%	None	2-3 normal salt solution
6-26	7-4	8 days	10%	None	1-3 normal salt solution
6-26	7-4	8 days	1%	None	Lake water

TABLE II. HEXAGENIA BILINEATA SAY.

Date of Incubation	Date Hatched	Period of Incubation	% Hatched	% Hatched In Check	Medium
6-30	7-10	10 days	20%	None	Normal salt solution
6-30	7-13	13 days	One egg	None	2-3 normal salt solution
6-30	7-13	13 days	One egg	None	1-3 normal salt solution
6-30	7-13	13 days	1-10%	None	Lake water

When the dishes with *Hexagenia bilineata* were re-examined on the 14th of July, approximately fifty percent of the eggs fertilized in the normal physiological salt solution had hatched;

of those fertilized in two-thirds normal physiological salt solution, two eggs had hatched; one percent of those fertilized in the one-third normal physiological salt solution had hatched; and two percent of those that were fertilized in lake water. The last examination of these dishes was made on the 24th of July. It was found that approximately fifty percent had hatched in each dish containing fertilized eggs. The dishes containing the eggs used as checks were examined on the same day. It was found that not a single one of these eggs had hatched.

CONCLUSIONS.

(1) The results for *Ephemera simulans* and *Hexagenia blineata* show that artificial fertilization is possible in these two species.

(2) Whether the medium in which the eggs and sperms are mixed has any effect upon the process of fertilization as shown by the number of eggs actually hatched is uncertain. Table I would seem to show that the medium did have an effect upon the process of artificially fertilizing mayfly eggs. It shows that there is a definite relation between the number of eggs hatched and the kind of medium used. Table II, however, shows no such relation between the number of eggs hatched and the kind of medium used.

(3) It would also be premature to conclude that artificial fertilization in *Sialis infumata*, *Acroneura evoluta*, and in *Chironomus plumosus* is impossible. The same is probably also true for crosses between *Hexagenia bilineata* and *Ephemera simulans*. More extensive experiments will be necessary before these questions can be settled definitely.

A PHYLOGENENTIC STUDY OF THE THORACIC SCLERITES OF THE NON-TIPULOID NEMATOCEROUS DIPTERA

G. C. Crampton, Ph. D.
Massachusetts Agricultural College, Amherest, Mass.

The present paper dealing with the thoracic sclerites of the non-Tipuloid Nematocera, together with a second paper already completed, dealing with the thoracic sclerites of the Tipuloid Nematocera, form the first of a series of phylogenetic studies of the Nematocerous Diptera undertaken at the suggestion of Dr. C. P. Alexander, who has furnished much of the material of importance used in this study, and to whose advice and suggestions is due whatever of value there may be in this work. The specimens collected by Mr. T. R. Harris, and those collected by Dr. J. W. Campbell and the New Zealand entomologists whom he has interested in my behalf, have furnished my chief source of material in this and other anatomical studies, and I am deeply indebted to these gentlemen for their interest and encouragement in this work, which could never have been undertaken, much less completed, without their aid. In addition to many past favors in this line, I am further indebted to Dr. O. A. Johannsen for the Mycetophilid material described in this paper, and Dr. B. P. Young has very kindly allowed me to sketch his only specimen of *Orphnephila*, thereby enabling me to complete the series of important forms here figured.

In several papers, I have called attention to the fact that the mesothoracic pleural suture which is almost straight in the lower or "Tipuloid" Diptera becomes sharply bent at an angle by the forward shifting of the pleural plates in the higher or "Muscoid" Diptera, and that the Leptidæ (s. lat.) present a condition intermediate between the higher and the lower Diptera, in this respect; but it was not until the publication of Dr. Young's excellent monograph of the thoracic sclerites of the Diptera that the full importance of these facts was brought out by a detailed comparison of the parts throughout the Diptera. Dr. Young's paper is undoubtedly the most important contribution to our knowledge of the thoracic sclerites since

the appearance of the classic paper by R. E. Snodgrass, in 1909; but unfortunately Dr. Young has omitted from his paper all mention of the neck and prothoracic sclerites which are among the most important of all thoracic structures for the study of relationships, and the most important "synthetic" types were not figured in his paper, which does not treat of the subject from the standpoint of phylogeny. On this account, I would present in the present paper, the evidence of the thoracic sclerites bearing upon the origin and interrelationships of the families of Nematocerous Diptera, with the exception of the Tipuloidea, which will be discussed more in detail in a separate paper, as befits their importance as the most primitive representatives of the Dipterous insects.

Before taking up the discussion of the parts in the Diptera themselves, I would briefly call attention to the character of the parts to be discussed, in those forms which have departed but little from the condition characteristic of the ancestors of the Diptera. In the primitive Mecopteran shown in Fig. 2, the lateral cervical plate *lc* articulates with an occipital condyle *occ* of the posterior region of the head capsule, and behind the lateral cervical plate *lc* is the reduced prothoracic pleural region composed of a small episternum es_1 and a narrow epimeron em_1. The pleural region is overlapped to some extent by the pronotum which is divided into an anterior region *apn* and a posterior region *ppn* by a well marked transnotal suture *e*. The significance of this division of the pronotum will appear later, in discussing the division of the pronotum of the Diptera into an anterior and posterior region (e. g., the regions labeled *apn* and *ppn* in Figs. 5, 11, 34, etc.).

In the neck region of the Trichopteran shown in Fig. 3, there is an anterior lateral cervical plate *alc*, which may represent the precursor of such small anterior lateral cervicals as those bearing the labels *alc* in the Diptera shown in Figs. 26 and 32, but in the Diptera here considered, the anterior lateral cervicals are small and unimportant. The prothoracic pleuron, composed of the plates *es* and *em*, of the Trichopteran shown in Fig. 3, is overlapped by the pronotum as in the Mecopteran shown in Fig. 2. In the Trichopteran shown in Fig. 3, however, there is a true prothoracic trochantin *tn*, not present in the other forms here considered; and a postcoxal plate *poc* occurs behind the coxa of the prothorax of this insect, although it

seems to be absent in the other forms here considered. A large coxa-bearing process *cf* is present in the insect shown in Fig. 3, and probably represents the coxa-bearing process labeled *cf* in the Diptera shown in Figs. 34, 37, 26, 13, 20, etc., while the area labeled *cm* in the posterior basal margin of the fore coxa of the Trichopteran shown in Fig. 3 may be the homologue of the structure labeled *cm* in the fore coxæ of the Diptera shown in Figs. 18, 19, 11, 14, etc.

In the pleural region of the mesothorax of the Mecopteran shown in Fig. 2, the episternal region es_2 is divided into an upper region aes_2 and a lower region spl_2. In the region *spl* is demarked a sclerite labeled *ptn* which represents the fusion product of the trochantin *tn* of Fig. 6 with the lower portion of the episternum, and a narrow marginal region of the pre-coxal bridge connecting the sternal region with the episternum. In the Mecopteran shown in Fig. 4, the region *ptn* of Fig. 2 becomes greatly reduced to form the small area labeled *ptn* in Fig. 4, while the upper region of the episternum labeled *aes* in Fig. 4 remains fairly large and well developed. Since the parts labeled *aes*, *spl*, and *ptn* in Fig. 4 have taken on, in the Mecopteran there shown, the character of the plates bearing the labels *aes*, *spl*, and *ptn*, in the Diptera shown in Figs. 29, 37, 34, 39, etc., it is a very easy matter to compare these sclerites in the Diptera, with those bearing the same labels in the Mecopteran shown in Fig. 4, which resembles them remarkably closely; and by comparing the Mecopteran shown in Fig. 4 with the primitive Mecopteran shown in Fig. 2, in which the parts are but little modified, it is a simple matter to determine their significance and to compare them with the parts in such primitive insects as the one shown in Fig. 6.

In such lower insects as the one shown in Fig. 6, the coxa is divided by a suture *d* (continuous with the pleural suture *c*) into an anterior region *ec* and a posterior region *m*, and this division into the regions labeled *ec* and *m* persists in the mesothoracic coxa of the Mecopteran shown in Fig. 2. In the metathoracic region of the Trichopteran shown in Fig. 1, the posterior region of the coxa, labeled *m*, migrates dorsalward and becomes closely associated with the ventral region of the epimeron *em*, although in the mesothorax of this same Trichopteran, the posterior region of the coxa remained as closely associated with the rest of the coxa as does its homologue labeled *m* in the

Mecopteran shown in Fig. 2, or Fig. 4. We thus see in the metathorax of the Trichoptera a well marked tendency for the posterior region *m* of the coxa to become closely associated with the epimeron, and the same tendency manifests itself in the mesothorax of the Diptera. Thus, in the Diptera shown in Figs. 5, 13, 14, 18, 26, 29, etc., the posterior region *m* of the coxa is still clearly associated with the rest of the coxa *ec*, while in such Diptera as the one shown in Fig. 11 or 16, the region *m* tends to become more closely associated with the lower portion of the epimeron *em*, and in such Diptera as the one shown in Fig. 19, the posterior division of the coxa fuses with a demarked lower area of the epimeron to form the composite sclerite, labelled *mpl* in Fig. 19. In the Diptera shown in Figs. 24, 25, etc., the union is still more intimate, and the epimeron appears to extend as a single (though composite) sclerite from the wing to a point far down the posterior surface of the apparent coxa, *ec*. In the lower insects, or in the Mecopteran shown in Fig. 2, for example, certain typical muscles connect the posterior coxal region *m* with the subalar plate *sal* and with the tergum, and in the mesothorax of the Diptera exactly the same muscles are attached to the posterior coxal region, labelled *m* in the above-mentioned Diptera, and connect it with the subalar plate labelled *sal* and with the tergum, in these Diptera, so that there can be no doubt as to the true homologies of the region labelled *m* in the Diptera, although it has been given an entirely different interpretation by many Dipterists and others who figure the parts in Diptera.

There is one other region of the Dipterous thorax, namely, the sternum, which should be briefly considered before taking up the discussion of the modifications of the sclerites met with in the different families of Nematocerous Diptera. In the thorax of the Dipteran shown in Fig. 8, the prothoracic sternal region contains an anterior faintly chitinized presternal area *ps*, followed by a basisternum *bs*, which is divided by a median ventral suture *z*. The prothoracic furcasternum *fs*, (which bears the furcal pits *fp*, or external manifestations of the internal projections of the furca for muscle attachment), is more or less closely united with the presternal region ps_2 of the mesothorax. The mesothoracic basisternum bs_2, is rather small, and is divided by the midventral suture *z*, into two parts, which are separated from the region spl_2, by the sutures labelled x_2 in Fig. 8. The

furcasternum of the mesothorax is divided into an anterior region afs_2, and a posterior region pfs_2, by the suture *w*, and the furcal pits of this sclerite of the mesothorax are hidden by the infolding of the integument along the midventral suture *z*. In the metathorax, the basisternum bs_3 is demarked from the lateral sternal regions ls_3 by the sutures labelled *x*, and the lateral sternal sclerites ls_3, are demarked from the episternum es_3 by the sutures labelled *y*. The meaning of these sclerites and sutures is indicated in the insect shown in Fig. 6, in which homologous parts, bearing the same labels, have remained in a more primitive condition, being separated by narrow membranous areas instead of by impressed lines. The furcal pits of the metathorax, labelled fp_3 in Fig. 8, are not drawn inward by an infolding of the integument along the midventral suture, as in the mesothorax of this insect, and the metathoracic furcasternum fs_3 is divided in a fashion somewhat different from that occurring in the mesothorax. The chief point brought out by the study of the sternal region of the Dipteran shown in Fig. 8, is that the so-called sternopleurite, labelled *spl* in the various Figures of Diptera, is formed by a fusion of the lower part of the episternum *es*, with a lateral sclerite of the sternum, called the laterosternite *ls;* and the basisternum *bs* (e. g. of Fig. 8) may remain distinct from the composite sclerite *spl*, if the lateral sutures *x* of Fig. 8 are retained, but if these sutures become obsolete, the whole sternal and lower episternal regions may merge or unite indistinguishably.

Of the Nematocera here discussed, the Tipuloid family Tanyderidæ represented by the insect shown in Fig. 7, and the Psychodoid family Bruchomyidæ represented by the insect shown in Fig. 10, are the most primitive. Allowing for the greater slenderness of the parts in the Bruchomyid, shown in Fig. 10, this insect is quite similar to such Tanyderids as the one shown in Fig. 7, particularly in the nature of the plate labelled *mpl*, the character of the sclerite *mt*, the general contour of the mesonotum, with the scutellum *sl*, and the general character of the mesopleural sclerites, particularly the small area labelled *saf*. The evidence of the thoracic sclerites would thus indicate that the Bruchomyids and Tanyderids sprang from a common ancestry. It would be impossible to derive the Bruchomyids from the Tanyderids, since the large metanotum *mtn* of Fig. 10, for example, is much more primitive than the narrow reduced metanotum *mtn* of Fig. 7, and could not be derived from the latter. On the other hand, the Tanyderids could not be derived from the Bruchomyids, because the broad pronotum *pn*, of

Fig. 7 is much more primitive than the narrow reduced pronotum *pn*, of Fig. 10, and could not be derived from the latter. These and many other features preclude deriving the Tanyderids from the Bruchomyids, or the Bruchomyids from the Tanyderids, so that since both are evidently closely related, we are forced to conclude that both were derived from a common stem, possibly some Protodipteran like *Aristopsyche*, which is very Mecopteroid in the character of its venation.

If *Aristopsyche* is not actually a Mecopteran, it should be regarded as a Protodipteran, with a venation extremely like that of the ancestors of the Diptera, as was pointed out by Tillyard, 1919, who, however, does not call it a Protodipteran. In any case, it is quite evident that the ancestral Diptera were derived either from the Mecoptera themselves, or from some Mecoptera-like forms, such as *Aristopsyche*, which have departed but little, if any, from the Mecoptera; and a study of the thorax of the Mecoptera, such as the one shown in Fig. 4, confirms the view that the ancestors of the Diptera were at least Mecopteroid, if not actually Mecopterous. From this Mecopteroid, or Mecopterous ancestry, then, were descended the common ancestors of the Tanyderids and Bruchomyids. The Tanyderid line of development apparently led off along paths of specialization which are of no particular interest from the standpoint of tracing the phylogeny of the insects under consideration here; but the line of development of the Bruchomyids apparently led to that of the Psychodids, and on this account is of considerable interest in tracing the descent of these non-Tipuloid Nematocera. (See also Tonnoir, 1922).

If we compare the thorax of the Psychodid shown in Fig. 9 with that of the Bruchomyid shown in Fig. 10, it is at once apparent that both exhibit many fundamental resemblances indicating an extremely close relationship between the two. Thus, the character of the narrow pronotum, *pn*, which is formed in the same peculiar fashion in both, points to a close relationship between the two, as also does the character of the broad metanotum, *mtn*, which is of this type only in the Psychodoid Diptera (with the exception of certain mutants of the fruit fly *Drosophila*, which likewise have such a broad metanotum—for example, in the mutant type known as "bithorax"). The general character of the sclerite *mpl*, in Fig. 9 is very suggestive of that of the sclerite *mpl*, of Fig. 10, which does not occur in exactly this fashion in the rest of the non-Tipuloid Nematocera. The sclerite *mt* is of essentially the same character in the insects shown in Figs. 9 and 10, and the general nature of the sclerites indicates such an intimate relationship between the two, that the evidence of the thoracic sclerites is clearly on the side of that from other sources, indicating that the Bruchomyidæ (including *Nemopalpus*, etc.) should be placed with the Psychodidæ in the superfamily Psychodoidea, which forms a rather isolated group of Nematocerous Diptera.

As was mentioned above, the thoracic sclerites of the Bruchomyidae and Tanyderidæ indicate that these families had a common ancestry, and represent early offshoots of the ancestral Diptera. In the Tany-

derids and Bruchomyids, however, the meron or posterior division of the coxa had already become detached from the rest of the coxa and had united with the lower region of the epimeron to form the sclerite labelled ***mpl***, in Figs. 7 and 10, thus indicating a degree of specialization in even these primitive Diptera. A third rather primitive type of Diptera is represented by the Tipuloid family Trichoceridæ, composed of two subfamilies, the Trichocerinæ, exemplified by the insect shown in Fig. 11, and the Diazosminæ, exemplified by the insect shown in Fig. 13. It is very difficult to determine where these Trichocerid Diptera arose. Unlike the Bruchomyids and Tanyderids, they have preserved a distinct meron ***m*** of Figs 11 and 13, and in this respect they are more primitive than either the Bruchomyids or Tanyderids, and therefore cannot be derived from either of these families. Furthermore, the Trichocerids have a well marked scutal suture, *s*, of Figs. 11 and 13, which is only feebly developed in the Tanyderids (Fig. 7) and is wanting in the Bruchomyids (Fig. 10), thus indicating that at least some of the Trichocerid tendencies were lacking in the common Bruchomyid-Tanyderid ancestral stem, and we must look further back than these, for the ultimate common ancestral types from which arose the Trichoceridæ, as well as the Bruchomyidæ and Tanyderidæ. In regard to their thoracic characters, these ancestral types apparently had distinct well-developed meral divisions of the mesothoracic coxæ (***m*** of Figs. 11 and 13) not united with the lower region of the epimeron; and they apparently had rather broad pronota, since the Trichocerids (Figs. 11 and 13) and Tanyderids (Fig. 7) both have rather broad pronota. The episternum of the mesothorax was apparently divided into an upper region, ***aes***, and a lower region, ***spl***, (Figs. 11, 7, and 10) in these ancestral types, and the pronotum had apparently begun to show signs of uniting with the pleural region in them, judging from the condition exhibited by all of their most primitive descendants (compare Figs. 11, 7, and 10). From such a common Protodipteran, or Mecopteroid ancestry, having the thoracic characters mentioned above, arose the ancestral Tanyderids, Bruchomyids and Trichocerids.

The line of development of the Trichocerids is of considerable interest, since the Trichocerids furnish us the nearest known types ancestral to the Anisopodidæ (although the Anisopodidæ were probably not descended from the Trichocerids themselves) which in turn are extremely like the ancestors of the non-Tipuloid Nematocera next to be considered. I would leave the Trichocerids with the Tipuloid Nematocera, and would place the Anisopodids with the non-Tipuloid Nematocera (as Mycetophiloids?) for several reasons, and the following evidence drawn from the thoracic sclerites would support such a grouping. The Trichocerids retain the Tipuloid scutal suture, *s*, of Figs. 11 and 13, while the Anisopodids (Figs. 18, 16 and 14) in common with most non-Tipuloid Nematocera, tend to lose it. The Trichocerid pronotum is rather broad, like that of most other Tipuloids, while the pronotum of the Anisopodidæ tends to become narrowed, like that of the rest of the non-Tipuloid Nematocera. Unlike the Trichocerids and other Tipuloids, the lateral neck plates of the Anisopodids shown in Figs. 18 and

16 are made up of a true laterocervical plate, *lc*, and a posterior laterocervical plate, *plc*, as is also the case with the other non-Tipuloid Nematocera shown in Figs. 21 and 20. Lastly, the Trichocerids, like most other Tipuloids, apparently lack a basalar pit, such as that labelled *bp*, in Figs. 18, 16 and 14, which is present in all of the Anisopodidæ which I have examined, and such basalar pits, *bp*, are likewise present in the other non-Tipuloid Nematocera shown in Figs. 21, 20, etc. In the above-mentioned thoracic characters, as well as in numerous other features, the Anisopodidæ have become non-Tipuloid, while the Trichoceridæ remain Tipuloid in these characters, and on this account, I have arbitrarily drawn the line separating the Tipuloids from the non-Tipuloids between the Anisopodidæ and their ancestral types, the Trichoceridæ, thus leaving the Trichoceridæ with the Tipuloids, and placing the Anisopodidæ with the non-Tipuloids, with which they are extremely intimately connected—more so, in fact, than they are with the Trichoceridæ. This method of arbitrarily drawing the line between the Tipuloid and non-Tipuloid Nematocera at this point, has certain disadvantages, but the line between the Tipuloid and non-Tipuloid Nematocera must be drawn somewhere, and the logical place for the division is apparently here!

With the exception of the Psychodid line of development, which arose from that of the Bruchomyidæ, as was mentioned above, the lines of development of the other non-Tipuloid Nematocera arose either from the Anisopodidæ themselves, or from Anisopodid-like ancestors so closely allied to the Anisopodidæ, that we can take the Anisopodidæ as the nearest living representatives of the types ancestral to the rest of the non-Tipuloid Nematocera. On this account, it is of the utmost importance to know all of the Anisopodid types, if we are to trace the various modificational tendencies exhibited by the non-Tipuloid Nematocerous families, to their source in Anisopodid-like forms.

The Anisopodid *Olbiogaster* (Fig. 16) is rather like *Anisopus* (Fig. 18) and might possibly, therefore, be grouped with *Anisopus* in the subfamily Anisopinæ. *Axymyia*, however, is quite different from either of these (see Fig. 14), and should be placed in a separate subfamily, the Axymyinæ. I have not seen *Lobogaster*, and therefore cannot say where this only other known Anisopodid genus belongs.

In so far as their thoracic characters are concerned, it may be noted that *Axymyia* (Fig. 14) has a large, clearly demarked meron, *m*, while the meron *m* of *Anisopus* (Fig. 18) is not so broad. In *Olbiogaster* (Fig. 16) the meron *m* is less clearly defined, and tends to unite with the lower region of the epimeron *em*, which tends to become slightly narrower than the epimeron *em* of Figs. 14 and 18. The tendency for the meron *m* to become reduced, and to unite with the epimeron *em*, which becomes further narrowed, is a tendency which is carried still further in the insect shown in Fig. 20, as well as that shown in Fig. 17, and furnishes one of the important clews in tracing the descent of the next group of non-Tipuloid Nematocera to be considered. In some Anisopodids, such as the one shown in Fig. 18, an upper region, *aem*, is demarked in the dorsal portion of the epimeron, and a similarly demarked sclerite

aem reappears in the insect shown in Fig. 20. Other Anisopodid features which reappear in the descendents of the Anisopodidæ are the basalar pit, *bp*, of Fig. 18, which reappears in the insects shown in Figs. 20 and 21, and the two peculiar lateral neck plates, *lc* and *plc*, of Fig. 18, which reappear in the insects shown in Figs. 20 and 21. Certain other features having a bearing in tracing the descendents of the Anisopodids, will be discussed elsewhere.

The nearest direct descendents of the Anisopodid-like ancestors of the non-Tipuloid Nematocera are the Mycetophyloid insects. Such Mycetophiloids as *Mycetobia*, shown in Fig. 20, furnish ideal transitional forms annectant between the Anisopodids and Mycetophiloids, and, as might be expected, *Mycetobia* has been placed in the same family with the Anisopodidæ by some, while others have regarded it as a Mycetophilid. In having a demarked upper region of the epimeron, labelled *aem*, the insects shown in Figs. 20 and 18 are very similar, and they are also very similar in the character of their prothoracic pleura, pronota, neck plates, mesonota, basalar pits (*bp*), and the sclerites labelled *mt*, *pt*, etc. Granting a remarkable resemblance in all of these thoracic features in the insects shown in Figs. 18 and 20, I would nevertheless maintain that the insect shown in Fig. 20 should be grouped with the other Mycetophiloids, such as the ones shown in Figs. 21, 17, etc., rather than with the Anisopodids such as the ones shown in Figs. 18, etc., for the following reasons. It is characteristic of all known Mycetophiloidea (Figs. 12, 17, 15, 21, etc.) for the mesothoracic epimeron em_2 to become markedly narrowed; and the meron m_2 becomes reduced in them, and tends to unite with the lower portion of the epimeron *em*. Unlike the condition exhibited by the true Anisopodidæ, the epimeron of *Mycetobia* (Fig. 20) becomes markedly narrowed, as in the Mycetophiloidea, and the meron tends to become united with the lower portion of the epimeron as in the Mycetophiloidea, so that in these fundamental features, *Mycetobia* is Mycetophiloid, not Anisopodid. Furthermore, no Anisopodidæ have a pre-coxal bridge connecting the prosternum *bs* with the prothoracic episternum *es*, as is the case with the Mycetophiloid shown in Fig. 21, and by having such a precoxal bridge connecting the prosternum *bs* with the episternum *es*, *Mycetobia* is thrown with the Mycetophiloids rather than with the Anisopodids. These important thoracic characters would therefore bear out the evidence from other sources, indicating that *Mycetobia* is a Mycetophiloid, and not an Anisopodid, (although *Mycetobia* is clearly annectant between the two), so that I formerly placed *Mycetobia* in a distinct family Mycetobiidæ of the superfamily Mycetophiloidea (Crampton, 1924).

Other Mycetophiloids closely related to *Mycetobia* (Fig. 20) are the Sciaridæ (Fig. 21), the Bolitophilidæ (Fig. 17) and the Mycetophilidæ (Figs. 12 and 15). It has been suggested that *Platyura* (Fig. 15) differs sufficiently from the other Mycetophilidæ, to warrant erecting for it a distinct family, the Platyuridæ, but the thoracic sclerites offer no evidence sanctioning such a course of procedure, and, on the contrary, the evidence of the thoracic sclerites points very clearly to the fact that *Platyura* (Fig. 15) belongs in the same family with the Mycetophilid

shown in Fig. 12, since in both of these insects, the sclerite labelled *mt* is bent at a peculiar angle, and the character of the sclerite labelled *pt* is peculiar to these types of Mycetophiloids alone, while the rest of the thoracic sclerites are so strikingly similar in these two insects (Figs. 12 and 15) that it is quite evident that *Platyura* (Fig. 15) belongs in the same family with the Mycetophilid shown in Fig. 12. The differences between the thoracic sclerites of the four Mycetophiloid families mentioned above are readily seen upon comparing Figs. 20, 21, 12 and 17, and therefore need not be further mentioned here.

In the Itonididæ, or Cecidomyidæ as they were formerly called, there is a marked tendency for the mesothoracic epimeron em_2 of Figs. 22, 36, and 38, to become greatly narrowed, and for the meron m to become reduced. This tendency is also characteristic of the Mycetophiloids mentioned above, and indicates that the Itonididæ should be included in the superfamily Mycetophiloidea, with whose members they are more closely related than any other insects known to me. The position of the metathoracic spiracle sp_3, which is located ventrally near the upper margin of the mesothoracic meral region m_2 in the Itonidid shown in Fig. 38 and the Mycetophiloid shown in Fig. 21, points to a close relationship between the two, as does the slender elongated character of the prothoracic pleuron, its connection with the prosternum by a precoxal bridge, and many other features, so that it is quite evident that the Itonididæ should be included in the superfamily Mycetophiloidea, which would then comprise the families Mycetobiidæ, Sciaridæ, Bolitophilidæ, Mycetophilidæ, Itonididæ, etc. The Anisopodidæ should also be included in this superfamily, since they are remarkably similar to its members, but the Anisopodidæ furnish the "starting point" for so many of the lines of descent of the non-Tipuloid Nematocera, that it is difficult to decide where to group them, although the Anisopodids are more like the Mycetophiloids than any other group.

With regard to the thoracic structures which would distinguish the Itonididæ from their Mycetophiloid relatives, the only really diagnostic character I have been able to discover is the narrow lateral cervical plate *lc* of Figs. 22, 36 and 36, which seems to be peculiar to the Itonididæ alone. Due to the fact that the neck region was much shrunken in the dried specimen from which Fig. 36 was drawn, it is impossible to see the lateral neck plate very clearly, and since the specimen is the type of a new species to be described by Dr. Alexander, it was not possible to boil up and soften the specimen to study its hidden details, so that I am not certain as to the character of its lateral neck plate, but from the glimpse of the neck region which I was able to obtain, it would appear that the insect shown in Fig. 36 also conforms to the Itonidid type in having a slender elongated lateral neck plate.

The next of kin to the Mycetophiloidea are the Bibionoid insects, and both groups apparently sprang from a common Anisopodid-like ancestry. The Bibionoid insect shown in Fig. 29, for example, has two peculiar lateral neck plates, labelled *lc* and *plc*, which are remarkably similar to the two peculiar lateral neck plates labelled *lc* and *plc* in the Mycetophiloid insects shown in Figs. 20 and 21; there is a pre-coxal

bridge connecting the prosternum *bs* with the prothoracic pleural region in all of these insects, and they resemble one another markedly in the character of their pronota, the position of the metathoracic spiracle, sp_3 (which is located near the dorsal margin of the meral membrane *m*), the general character of the upper region of the episternum *aes*, and many other features indicating a close relationship between the Bibionoids and Mycetophiloids.

Hesperinus (Fig. 26) has been placed in the Mycetophilids by some investigators, while others place it in the Bibionids, so that one would expect that the thoracic structures of *Hesperinus* would exhibit a condition intermediate between the Mycetophilids and the Bibionids. The thoracic sclerites of *Hesperinus*, however, are almost exactly like those of the Bibionoid insect shown in Fig. 29, thus indicating the value of the thoracic sclerites in determining where to place an insect whose position is in doubt. The contour of the sclerite *mt* (and of sclerite *pt* also) of Fig. 26, of *Hesperinus*, is not sharply "declivitous" and elongated as in the Mycetophiloid shown in Fig. 17, for example, but is short and "projecting," as in the Bibionid shown in Fig. 29. Similarly, the meron *m* of Fig. 26 is like that of 29, and is not at all like the meron *m* of Fig. 17, while the mesothoracic epimeron em_2 of Figs. 26 and 29 is not greatly narrowed as in Fig. 17 of the Mycetophiloid. The oblique slant of the prothoracic epimeron *em* of Fig. 26 is exactly like that of the Bibionid shown in Fig. 29, and both of these insects are very different from the Mycetophiloid shown in Fig. 17, in these and many other features, so that one has no hesitancy in grouping *Hesperinus* (Fig. 26) with the Bibionoid insect shown in Fig. 29, rather than with such Mycetophiloids as the one shown in Fig. 17, after examining the evidences of relationship furnished by the thoracic sclerites. I have not been able to obtain a specimen of the genus *Pachyneura*, which is placed next to *Hesperinus* in the subfamily Pachyneurinæ by Dipterists; but since these two genera are grouped so closely together by Dipterists, I imagine that what applies to one applies to both, and *Pachyneura* is therefore probably closely related to the Bibionid *Plecia*, shown in Fig. 29, if *Pachyneura* is so closely related to *Hesperinus*. At any rate, *Hesperinus* (Fig. 26) is so closely related to the Bibionid shown in Fig. 29 (*Plecia*), that whatever group contains *Hesperinus* must contain *Plecia* also, and if *Hesperinus* be placed in the family "Pachyneuridæ," as is done by some investigators, then *Plecia* also must be placed in the "Pachyneuridæ" if *Hesperinus* is to remain in this family.

Bibionidæ such as *Dilophus* (Fig. 32) resemble *Plecia* (Fig. 29) in having a precoxal bridge connecting the prosternum *bs* with the prothoracic episternum *es*, and the character of the two lateral neck plates *lc* and *plc* is the same in both *Dilophus* and *Plecia*. *Dilophus* (Fig. 32) is somewhat intermediate between *Plecia* (Fig. 29) and the Scatopsidæ, such as the one shown in Fig. 31, the prothoracic episternum *es* of *Scatopse* (Fig. 31) being somewhat like that of *Dilophus* (Fig. 32, es), and the mesothoracic meron *m* is somewhat alike in these two insects. *Dilophus* (Fig. 32) shows indications of a tendency to form a bend in the mesothoracic pleural suture *c*, at about the level of the anepisternal

suture *a*, and in *Scatopse* (Fig. 31), the bend in the pleural suture *c* becomes very marked. In the Aspistidæ (Fig. 28) the bend in the mesothoracic pleural suture *c* becomes even more pronounced, so that the tendency for the pleural suture to become sharply bent in the mesothorax of the higher Diptera manifests itself already in the rather primitive, Bibionoid Nematocera, and this fact is one of considerable phylogenetic significance, since it indicates that the Bibionoid stem branched off at the point where the lines of descent of the higher Diptera arose from their Anisopodid-like ancestors and the Bibionoids inherited certain characters in common with them from this source. The character of the thoracic sclerites of the Bibionoids would indicate that *Plecia* and *Hesperinus* ("Pachyneuridæ"?) are the most primitive representatives of the Bibionoids, while Bibionidæ such as *Dilophus* are intermediate between these and the Scatopsidæ; and the Aspistidæ apparently branched off from the Scatopsidæ, or from Scatopsid-like ancestors.

The Simuliidæ (Fig. 33) are somewhat intermediate between the Bibionoidea and the Chironomoidea, with their affinities slightly on the side of the Chironomoids, so that it is extremely difficult to determine whether to group them with the Bibionoids or Chironomoids; but provisionally, at least, I would place the Simuliids among the Chironomoidea because of certain thoracic features which they have in common with the latter superfamily. If we compare a Simuliid such as the one shown in Fig. 33, with a Ceratopogonid Chironomoid such as the one shown in Fig. 30, the resemblance between the two is very marked. The lateral cervical plate *lc* is very slender in both insects, and the posterior lateral cervical plate *plc* is produced ventro-mesally in both. The character of the pronotum is very similar in the two insects shown in Figs. 30 and 33, as is also true of the way in which the upper region of the episternum is divided by a wide anepisternal cleft, *ac*, into an anterior region, *aa* and *pa*, in these two insects; and the sclerites *ptn* and *m* about the base of the mesothoracic coxa are very much alike in the two insects shown in Figs 33 and 30 (compare also Fig. 27), so that the evidence of the thoracic sclerites would be in favor of grouping the Simuliidæ with the Chironomoidea. It is to be expected that such forms as the Simuliidæ would exhibit certain characters in common with both Bibionoids and Chironomoids, since the Chironomoidea apparently sprang from the common Anisopodid-like ancestors of the Bibionoids and Mycetophiloids, and they have taken over a number of Bibionoid tendencies from this common ancestry. Some Chironomoids, for example, such as the one shown in Fig. 39, have a precoxal bridge connecting the prosternum with the propleuron, and there are indications of the presence of the homologue of a posterior lateral cervical plate *plc* in the Chironomoid shown in Fig. 39, which thus exhibits certain tendencies present in the Bibionoids (Fig. 29) and Mycetophiloids (Fig. 21) apparently inherited from a common ancestry with the Bibionoids and Mycetophiloids, so that the Chironomoids apparently likewise sprang from the Anisopodid-like ancestors of the Bibionoids and Mycetophiloids.

The nature of the thoracic sclerites would indicate that the Simuliidæ (Fig. 33) are rather closely related to the Ceratopogonidæ (Fig. 30), and that the Thaumaleidæ (Fig. 27), or Orphnephilidæ, as they are usually called, are related both to the Ceratopogonidæ (Fig. 30) and the Chironomidæ (Fig. 41). In the character of its thoracic sclerites, the Chironomid shown in Fig. 41 resembles both the Ceratopogoninæ (Fig. 30) and the Tanypinæ (Fig. 35). The Tanypine shown in Fig. 35 is as primitive as any Chironomoid I have seen, and it shows certain evidences of affinities with the Charoborid Culicoidea, while the oblique, slash-like anepisternal or basalar cleft *ac* of the Chironomoid shown in Fig. 39 is very suggestive of the oblique slash-like anepisternal cleft *ac* of the Culicid Culicoid shown in Fig. 40. The thoracic sclerites of the insect shown in Fig. 39 differ sufficiently from those of the Ceratopogonid shown in Fig. 30 to warrant placing the insect shown in Fig. 39 in a distinct family, the Johannsenomyidæ, which represents an offshoot of the Ceratopogonidæ, or of the ancestors of the Ceratopogonidæ.

As was mentioned above, the superfamily Chironomoidea is made up of the families Simuliidæ, Ceratopogonidæ, Thaumaleidæ (Orphnephilidæ), Chironomidæ, and Johansenomyidæ; and the Chironomoidea were apparently descended from the Anisopodid-like ancestors of the Mycetophiloidea and Bibionoidea, with their closest affinities somewhat on the side of the Bibionoidea, rather than the Mycetophiloidea. The Chironomoidea are intermediate between the Bibionoids and Culicoids, and it is a question as to whether to include the Culicoids and Chironomoids in the same superfamily or not, so closely related are these two groups of Nematocera!

The superfamily Culicoidea includes the families Culicidæ, Dixidæ and Chaorboridæ (Corethridæ), forming a compact superfamily closely related to the Chironomoidea. The thorax of the Culicidæ is characterized by the peculiar, oblique, slash-like, anepisternal or basalar cleft *ac* of Fig. 40, and by the fusion of the posterior anepisternum, *pa*, with the sternopleurite *spl*. The Chironomoid shown in Fig. 39, likewise has an oblique slash-like anepisternal cleft *ac*, and its anepisternal suture *a* tends to become obsolete—a tendency which, if completed, would result in the fusion of the posterior anespisternum *pa* with the sternopleurite *spl*, as in the Culicid shown in Fig. 40, and it also has a broad paratergite *pat*, like that of the Culicids, (Fig. 40). The two insects shown in Figs. 39 and 40, therefore, have much in common, and apparently inherited these common tendencies from a common ancestry, even though they possibly belong to different superfamilies.

The Chaorborid shown in Fig. 34 has a more vertical basalar or anepisternal cleft *ac* than the Culicid shown in Fig. 40 has; and in this respect the Chaorborid shown in Fig. 34 is approached by the Chironomoid shown in Fig. 35, which likewise tends to preserve the anepisternal suture *a*, as in the Culicoids shown in Figs. 37 and 34. The Chaorborid shown in Fig. 34 has a mesothoracic meron *m*, somewhat like that of the Chironomoid shown in Fig. 35, and a meso-ventral prolongation of

the lateral cervical *lc*, occurs in both the Culicoids shown in Figs. 37 and 34, and the Chironomoid shown in Fig. 35.

These and many other facts point to a common ancestry for the Culicoids and Chironomoids, and the two might even be combined into a single superfamily, but it is preferable to keep them distinct, for the sake of convenience, in the following discussion. The Dixidæ (Fig. 37) are among the most primitive of the Culicoidea, and they have departed but little from the common stock from which the Culicids (Fig. 40) and Chaorborids (Fig. 34) were derived. The mesothoracic meron *m* of the Dixids (Fig. 37) is more like that of the Culicids (Fig. 40, *m*), but the vertical anepisternal cleft *ac* of the Dixids (Fig. 37) is more like that of the Chaorborids (Fig. 34) than it is like the oblique anepisternal cleft *ac* of the Culicids (Fig. 40); and in their tendency to preserve the anepisternal suture *a*, the Chaorborids, such as the one shown in Fig. 34, are closer to the Dixids (Fig. 37) than are the Culicids (Fig. 40) which tend to lose this suture.

One of the distinguishing thoracic characters of the Culicoids is the well-developed posterior division of the pronotum *ppn* of Figs 40, 37, and 34, (compare with the region labelled *ppn* in Fig. 5), which assumes a triangular outline of these insects, and is proportionately larger than in other non-Tipuloid Nematocera. This region is sometimes erroneously called the prothoracic epimeron, but a comparison with the pronotum of the Tipuloid shown in Fig. 5, will at once show that the region labelled *ppn* in Figs. 34, 37 and 40, represents a posterior subdivision of the pronotum, as is also indicated by the attachment of the muscles in this region. (See also paper by Freeborn, 1924).

The Culicoids (Figs. 34, 37 and 40) usually have a well-developed meron *m*, and the sclerite *ptn* is usually quite well developed in them. The metathoracic spiracle sp_3 is usually quite widely removed from the upper angle of the meron *m*, and the lateral cervicals *lc* tend to become produced ventro-mesally— in which characters the Culicoids are paralleled by the Chironomoids, to some extent. The contour of the mesonotum of the Culicoids tends to become rather "low" and elongated and the prothoracic coxafer *cf* of Figs. 37, 34, and 40, is frequently large and well-developed in them—although in this respect also, they are paralleled by the Chironomoids. In fact, with the exception of the character of the well developed posterior pronotum *ppn* of the Culicoids (Figs. 34, 37 and 40) and the broader lateral cervical *lc* of these insects, I know of no thoracic structure which would differentiate the Culicoids from the Chironomoids in every case, and the nature of the thorax in the two groups points to a common ancestry for the Culicoids and Chironomoids. These common ancestors apparently arose at the point where the lines of descent of the Bibionoidea branched off from the Anisopodid-like forebears of the non-Tipuloid Nematocera, and the Chironomoidea may be regarded as in a sense intermediate between the Bibionoidea and the Culicoidea.

Thus far, the thoracic sclerites have clearly and unmistakably pointed the way in attempting to trace the paths of evolution followed by the various groups of non-Tipuloid Nematocera, and the evidence of

the thoracic sclerites as to the origin and interrelationships of these groups is amply borne out by that from other parts of the body as well. When we come to the consideration of the Blepharoceroidea, however, neither the thoracic sclerites, nor any other known structures seem to be of any avail in attempting to determine the origin and affinities of this compact, isolated group of insects! The head and wings of such primitive Blepharoceroids as *Edwardsina* would point to an origin for the group in ancestors related to the Tipuloid family Tanyderidæ, and it is possible that the Blepharoceroids are descended from some unknown forms which branched off from the common ancestors of the Tanyderids and Bruchomyids; but I am inclined to think that the Blepharocerids arose from the common Anisopodid-like ancestors of the Culicoids, Chironomoids, Blepharoceroids and Mycetophiloids.

In attempting to determine the origin and affinities of the Blepharoceroids, their thoracic characters may be diagnosed as follows. The large anterior pronotum *apn* of Fig. 24 of *Edwardsina* is more suggestive of the large anterior pronotum *apn* of the Tanyderid shown in Fig. 7, than of any other insect here figured. The general character of the prothoracic sclerites of the Blepharocerid shown in Fig. 25, however, is as much like that of the Trichoceridæ (Figs. 13 and 11) as any, and doesn't offer any very serviceable clews of a relationship to the non-Tipuloid Nematocera. The lateral neck plates *lc* and *plc* of the Blepharocerid shown in Fig. 24 are somewhat suggestive of those of the Chironomoid shown in Fig. 27, or even of the Chironomoid shown in Fig. 33, and the wide character of the meosthoracic epimeron *em* of the Blepharocerids is suggestive of the Chironomoids or Culicoids. The complete fusion of the mesothoracic meron *m* with the epimeron *em* in the Blepharoceroids (Figs. 23, 24, and 25) to form the region labelled *mpl*, is suggestive of the condition met with in the Tanyderids (Fig. 7) or Bruchomyids (Fig. 10), but the non-Tipuloid Nematocera do not appear to exhibit a strong tendency for the mesothoracic meron *m* to fuse with the epimeron *em*, although a suggestion of this tendency appears in such Bibionoids as the ones shown in Figs. 28, 31, etc., and the meron *m* is rather closely associated with the epimeron *em* in the Chironomoids shown in Figs. 27, 33, etc., or in the Culicoids shown in Figs. 37 and 40. The Culicoid shown in Fig. 37 has a broad epimeron *em* like that of the Blepharoceroids (Figs. 24 and 25), and the anterior pronotum *apn* of the Culicoid shown in Fig. 37 is somewhat like the anterior pronotum *apn* of the Blepharoceroid shown in Fig. 25 or Fig. 23; but the resemblance between the thoracic sclerites of the Culicoids and Blepharoceroids is not as great as one would expect would be the case from certain other points of resemblance between the two groups! The general character of the mesonotum of the Blepharoceroid shown in Fig. 25 is suggestive of that of the Bibionoid shown in Fig. 26, (and somewhat less so of the Culicoid shown in Fig. 34) and the greatly reduced, backward-projecting postscutellar sclerites *mt* and *pt* of the Blepharocerids shown in Figs. 25, 24, and 23, are more suggestive of those of the Bibionoids shown in Figs. 31, 32, 29, etc., than any other forms here figured (with the possible exception of the Tanyderid shown in Fig. 7). From the

foregoing, it is apparent that the evidence available is inadequate to enable us to determine definitely whether the Blepharoceroids are descended from the Tanyderid-like ancestors of the Tipuloidea, or from the Anisopodid-like ancestors of the non-Tipuloid Nematocera, although there is some evidence that the latter is the more probable view. The nature of the thoracic sclerites would indicate that the genus *Edwardsina* (Fig. 24) differs enough from the rest of the Blepharocerids to warrant placing it in a distinct subfamily, the Edwardsininæ, which with the Blepharocerinæ, form the main subfamilies of the Blepharoceridæ.

Dipterists are fairly well in accord in considering that the family Leptidæ (*sensu lato*) represents as nearly as any group, the ancestors of the Brachycerous Diptera, but no one, so far as I am aware, has suggested that the Leptidæ also arose from the Anisopodid-like ancestors of the Nematocera. The thoracic sclerites of the Leptidæ (Fig. 19), however, clearly indicate that they are among the most primitive representatives of the Brachycera, and that the Leptidæ were derived from Anisopodid-like ancestors. Thus, in the character of the pleural suture *c* of Fig. 19, the Leptids are intermediate between the lower Diptera, in which the mesothoracic pleural suture *c* extends from the alifer, or wing-bearing process, to the coxifer, or coxa-bearing process, in an almost straight line (see Figs. 18, 20, etc.), while in the higher Diptera, there is a sharp angular bend in this suture (somewhat like the suture *c* of the insect shown in Fig. 28). In the Leptidæ, the pleural suture *c* becomes slightly "angulate," but is not so sharply bent as in the higher Diptera, and in this respect the Leptidæ are intermediate between the higher and lower Diptera, as was pointed out by me in several papers. I also called attention to the fact that the Therevidæ are very like the Leptidæ in the general character of their thoracic sclerites, and were probably derived from Leptid-like ancestors, and that the Leptidæ and Therevidæ furnish the important starting points for tracing the lines of descent of the Brachycera, which in turn are like the forms from which the Cyclorhapha were derived. Since I am hoping to take up the discussion of the lines of descent of the Brachycera in another paper, I shall merely point out here, that the Leptidæ have preserved the thoracic sclerites in as primitive a condition as any known Brachycera, and that the evidence of their thoracic sclerites clearly points to an Anisopodid-like ancestry for the Leptidæ.

The character of the lateral cervical plate *lc* of the Leptid shown in Fig. 19, which forks anteriorly, is extremely suggestive of that of the Anisopodid shown in Fig. 18, in which the lateral cervical *lc* also forks anteriorly in exactly the same fashion. There is a posterior lateral cervical *plc* in the Leptid shown in Fig. 19, but this posterior lateral cervical *plc* has united to some extent with the prothoracic episternum *es* behind it—and the same tendency for the posterior lateral cervical *plc* to unite with the prothoracic episternum *es* is exhibited by the descendents of Anisopodid-like ancestors shown in Figs. 21 and 20, so that the same tendencies are apparently operative in both groups of insects. The general character of the prothorax of the Leptid shown in Fig. 19 is much like that of the Anisopodid shown in Fig. 18, (both

insects even have a coxamacula, *cm*), although the prothoracic epimeral region, *em*, is somewhat more like that of the descendent of Anisopodid-like forebears shown in Fig. 21. In the Anisopodid shown in Fig. 16, the mesothoracic meron *m* tends to unite with the lower portion of the epimeron *em*, and in the Leptid shown in Fig. 19 this tendency is carried still further, the sclerite labelled *mpl* in Fig. 19 being the fusion product of the meron and the lower portion of the epimeron. The postscutellar sclerites *mt* and *pt* of the Leptid shown in Fig. 19 are quite like the sclerites *mt* and *pt* in the Anisopodid shown in Fig. 16, and the general character of the mesonotum is much the same in both insects. The evidence of the thoracic sclerites would thus point very strongly to an Anisopodid-like ancestry for the Leptidæ, and hence for the lines of descent of the Brachycera in general, since the Leptidæ are very like the ancestors of the Brachycera, and even such minor details as the metathoracic epimeral sculpturing labelled *scl* in Fig. 19, which is characteristic of certain other more highly developed Brachycera as the Tabanidæ, etc., has already begun to develop in the Leptid shown in Fig. 19.

SUMMARY.

The chief points brought out in the foregoing discussion may be briefly summarized as follows: The families Tanyderidæ, Bruchomyidæ, and Trichoceridæ are among the most primitive living types of Diptera, and apparently sprang from Mecopteroid ancestors related to the fossil Protodipteran *Austropsyche*. The Tanyderid line of development leads to that of the Ptychopteridæ, which are of no especial interest in tracing the lines of descent of the non-Tipuloid Nematocera (unless the Blepharoceridæ were derived from Ptychopterid-like ancestors—a possibility which should be further investigated).

The closest allies of the Bruchomyidæ, among the lower Diptera, are the Tanyderidæ, but neither family can be derived from the other, and both were apparently descended from a common ancestor related to the ancestor of the Trichoceridæ. The line of descent of the Bruchomyidæ leads to that of the Psychodidæ, and these two families form a rather isolated group of Nematocerous Diptera.

The Trichoceridæ are very like the ancestors of the remainder of the Tipuloid Nematocera, and the Anisopodidæ were derived from Trichocera-like ancestors. The Trichoceridæ retain too many Tipuloid characters to separate them from the Tipuloidea, but the Anisopodidæ have developed so many characters in common with the non-Tipuloid Nematocera, that the

line demarking the non-Tipuloid from the Tipuloid Nematocera should be drawn between the Trichoceridæ and the Anisopodidæ.

The Mycetophiloidea may be the direct descendants of the Anisopodidæ, and if the Mycetophiloidea were not descended from the Anisopodidæ themselves, they were descended from Anisopodid-like ancestors extremely closely related to the family Anisopodidæ. The line of development of the Itonididæ parallels that of the Mycetophiloidea so closely that the Itonididæ should be grouped in this superfamliy.

The Bibionoidea were descended from the Anisopodid-like ancestors of the Mycetophiloidea, and the Bibionoidea are extremely closely related to the Mycetophiloidea, the two lines of development paralleling one another very closely. The Bibionoidea are in a sense intermediate between the Mycetophiloidea and the Chironomoidea.

The Chironomoidea are related both to the Bibionoidea and the Culicoidea, and are in a measure intermediate between the two. The Chironomoid family Simuliidæ partakes of characters in common with both Bibionoidea and Chironomoidea, but its closest affinities are probably with the Chironomoidea. The Chironomoidea are extremely closely related to the Culicoidea, and might be included in a single superfamily with the latter, but the two are retained distinct for the sake of convenience. The Chironomoid line of descent apparently branched off from the Anisopodid-like ancestors of the Bibionidæ.

The Culicoidea form a rather compact group, but certain Chironomoidea exhibit so many characters in common with the Culicoidea that the two groups intergrade, and might be regarded as members of a single superfamily. The Culicoidea were apparently descended from the Anisopodid-like ancestors of the Chironomoidea.

The origin and affinities of the Blepharoceroidea have not been determined. The Blepharocerid line of development may lead back to such Tipuloid forms as the Tanyderidæ and Ptychopteridæ, or the Blepharocerids may have descended from the Anisopodid-like ancestors of the Culicids, Bibionids, etc.

The Leptidæ are the nearest living representatives of the ancestral Brachycera. The Leptids were apparently descended from Anisopodid-like ancestors, and they furnish us the types intermediate between the Nematocera and the Brachycera.

BIBLIOGRAPHY.

1920. Alexander. A new Family of Tanyderid Flies: Ann. Ent. Soc. America, 13, p. 402.
1921. Alexander. The Craneflies of N. Y., Pt. II, Biology and Phylogeny, Ithaca, N. Y.
1909. Crampton. Contribution to the Knowledge of the Thoracic Sclerites of Insects: Proc. Acad. Nat. Sciences Philadelphia, Lan. 1909, p. 3.
1914. Crampton. Notes on the Thorœcic Sclerites of Winged Insects: Ent. News, 25, p. 5. See also Zool. Anzeiger, 44, p. 56 for Basic Plan of Segment.
1914. Crampton. Misuse of Terms for Thoracic Sclerites: Jour. N. Y. Ent. Soc. 22. p. 248.
1915. Crampton & Hasey. Basal Segments of the Leg in Insects: Zool. Jahrb. Anat. 39, p. 1.
1919. Crampton. Terga and Wing Bases of Diptera, etc.: Psyche, 26, p. 58. See also Psyche 25, p. 4.
1924. Crampton. Phylogeny of Nematocera: Psyche, 31, p. 238.
1916. Edwards. Systematic Position of Mycetobia: Ann. Mag. Nat. History, Ser. 8, 17, p. 108.
1923. Edwards. Notes on the Anisopodidae: Ibid., Ser. 9, 12, p. 475.
1924. Freeborn. Epimera of Mosquitos: Insec. Ins. Menstruus, 12, p. 37.
1909. Handlirsch. Fossilen Insekten.
1917. Malloch. Classification of Dipterous Larvæ: Bull. Illinois, 12, p. 161.
1909. Snodgrass. Thorax of Insects: Proc. U. S. N. Museum, 26, No. 1687.
1922. Tonnoir. Notes sur le Genre Nemopalpus: Ann. Soc. Ent. Belgique, 62, p. 125.
1908. Williston. North Amer. Diptera.
1921. Young. Attachment of Abdomen to Thorax in Diptera, Cornell Memoir 44.

EXPLANATION OF PLATES.

Unless otherwise stated, all views are of the left side (sinistral view) of the insects in question.

PLATE I.

Fig. 1. Metathorax of Trichopteran.
Fig. 2. Pro-, and mesothorax of Mecopteran *Chorista australis*.
Fig. 3. Prothorax of Trichopteran.
Fig. 4. Pro-, and mesothorax of Mecopteran *Bittacus* sp.
Fig. 5. Prothorax and part of mesothorax of Tipulid *Limnophila macrocera*.
Fig. 6. Portion of metathorax of termite *Termopsis angusticollis*.
Fig. 7. Thorax of Tanyderid Tipuloid *Protoplasa fitchii*.
Fig. 8. Ventral view of thorax of Tipulid *Gnophomyia tristissima*.
Fig. 9. Thorax of Psychodid *Psychoda* sp.
Fig. 10. Thorax of Bruchomyid *Bruchomyia argentina*.

PLATE II.

Fig. 11. Thorax of Trichocerid Tipuloid *Trichocera bimaculata*.
Fig. 12. Thorax of Mycetophilid *Asyndulum montanum*.
Fig. 13. Thorax of Trichocerid Tipuloid *Diazosma subsinuata*.
Fig. 14. Thorax of Anisopodid *Axymyia furcata*.
Fig. 15. Thorax of Mycetophilid *Platyura mendosa*.
Fig. 16. Pro-, and mesothorax of Anisopodid *Olbiogaster africana*.
Fig. 17. Thorax of Mycetophiloid *Boletophila cinerea*.

PLATE III.

Fig. 18. Thorax of Anisopodid *Anisopus punctatus*.
Fig. 19. Thorax of Leptid *Chrysopilus* sp.
Fig. 20. Thorax of Mycetophiloid *Mycetobia divergens*.
Fig. 21. Thorax of Mycetophiloid *Sciara* sp.
Fig. 22. Thorax of Itonidid *Catocha* sp. n.
Fig. 23. Pro- and mesothorax of Blepharocerid.
Fig. 24. Same of *Edwardsina australiensis* (Blepharocerid).
Fig. 25. Same of *Blepharocera tenuipes* (Blepharocerid).

PLATE IV.

Fig. 26. Pro- and mesothorax of Bibionoid *Hesperinus brevipes*.
Fig. 27. Same of *Orphnephila americana* (Chironomoid).
Fig. 28. Same of *Aspistes berolinensis* (Bibionoid).
Fig. 29. Same of *Plecia* sp. (Bibionoid).
Fig. 30. Same of *Ceratopogon* sp. (Chironomoid).
Fig. 31. Same of *Scatopse sp.* (Bibionoid).
Fig. 32. Same of *Dilophus* sp. (Bibionoid).
Fig. 33. Same of *Simulium* sp. (Chironomoid).

PLATE V.

Fig. 34. Pro-, and mesothorax of Culicoid *Eucorethra underwoodi*.
Fig. 35. Thorax of Chironomoid *Protanypus* sp.
Fig. 36. Thorax of Itonidid *Catocha* sp. n.
Fig. 37. Thorax of Culicoid *Dixa bimaculata*.
Fig. 38. Thorax of Itonidid *Rhabdophaga brassicoides*.
Fig. 39. Pro- and mesothorax of Chironomoid *Johannsenomyia bimaculata*.
Fig. 40. Pro- and mesothorax of Culicoid *Psorophora* sp.
Fig. 41. Same of *Diamesa waltlii* (Chironomoid).

ABBREVIATIONS

The subscripts 1, 2, 3 indicate that the structures in question belong to the pro-, meso-, and metathorax, respectively.

a.....Anepisternal suture.
aa.....Anterior anepisternum (preanepisternum).
aba....Anterior basalare (prebasalare).
ac.....Anepisternal cleft.
aem...Anepimeron or pteropleurite.
aes....Anepisternum.
af.....Alifer.
afs.....Anterior furcasternum (prefurcasternum).
alc....Anterior laterocervicale (precervicale).
apn....Antepronotum.
b.....Anepimeral suture.
bp.....Basalar pit.
bs.....Basisternum.
c.....Pleural suture.
cf.....Coxifer.
cm....Coxamacula.
cx.....Coxa.
d.....Meral suture.
dc.....Disticoxite.
e.....Transotal suture.
ec.....Eucoxa.
em....Epimeron.
es.....Episternum.
f.....Subalar suture.
fs.....Furcasternum.
fp.....Furcal pits.
g.....Pleurotrochantinal suture.
ip.....Interpleural pit.
kem...Katepimeron or hypoepimeron.
lc.....Laterocervicale
ls.....Laterosternite or parasternite.
m.....Meron (merocoxa) or meral membrane.
mp....Midpleural pit.
mpl...Meropleurite.
mt.....Mediotergite.
mtn...Metanotum.
nm....Notomacula.
occ....Occipital condyle.
p.....Prescutal suture.
pa.....Posterior anepisternum (postanepisternum).
pas....Parascutellum.
pat....Paratergite.
pba....Posterior basalare (postbasalare).
pfs.....Postfurcasternum.
plc....Posterior laterocervicale (postcervicale).
pn.....Pronotum.
poc....Postcoxale.
ppn....Postpronotum.
pra....Prealar bridge (prealare).
ps.....Presternum.
psc....Prescutum.
psl.....Postscutellum.
psp....Prespiraculare.
pt.....Pleurotergite or postalare.
ptn....Pleurotrochantin.
s.....Scutal suture (V-shaped).
saf.....Subalifer.
sal.....Subalare.
sc.....Scutum.
scl.....Sculpturae.
sl.....Scutellum.
sp.....Spiracle of mesothorax.
sp_3.....Spiracle of metathorax.
spl.....Sternopleurite or katepisternum.
tg.....Tegula.
tn.....Trochantin.
v.....Basisternal suture.
w.....Transternal suture.
x.....Sternopleural suture.
y.....Laterosternal suture.
z.....Midventral suture.

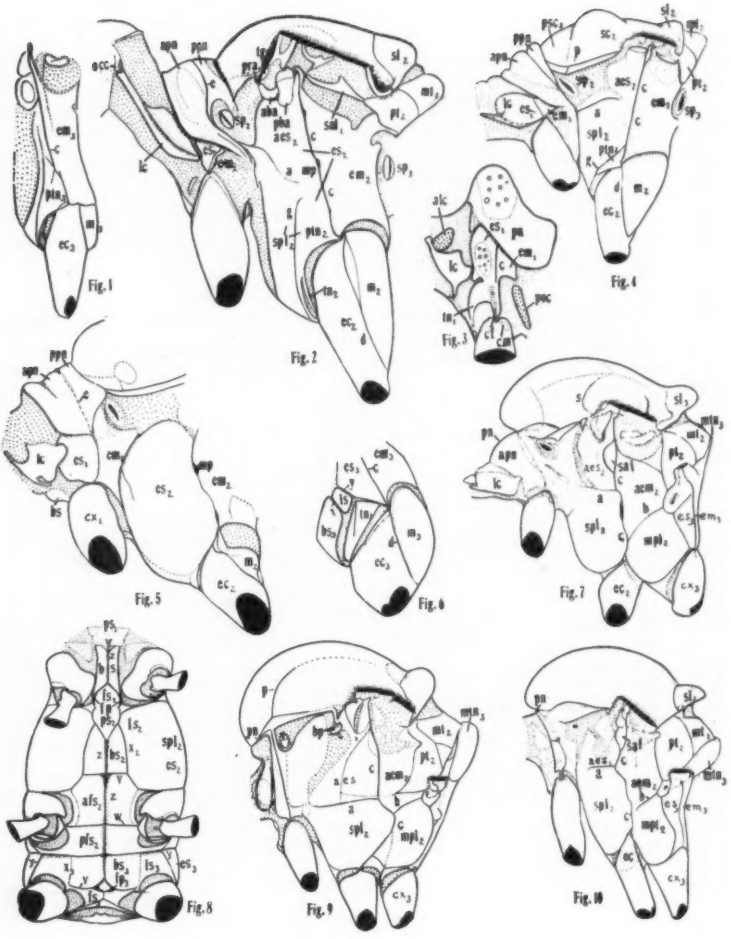


Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9

Fig. 10

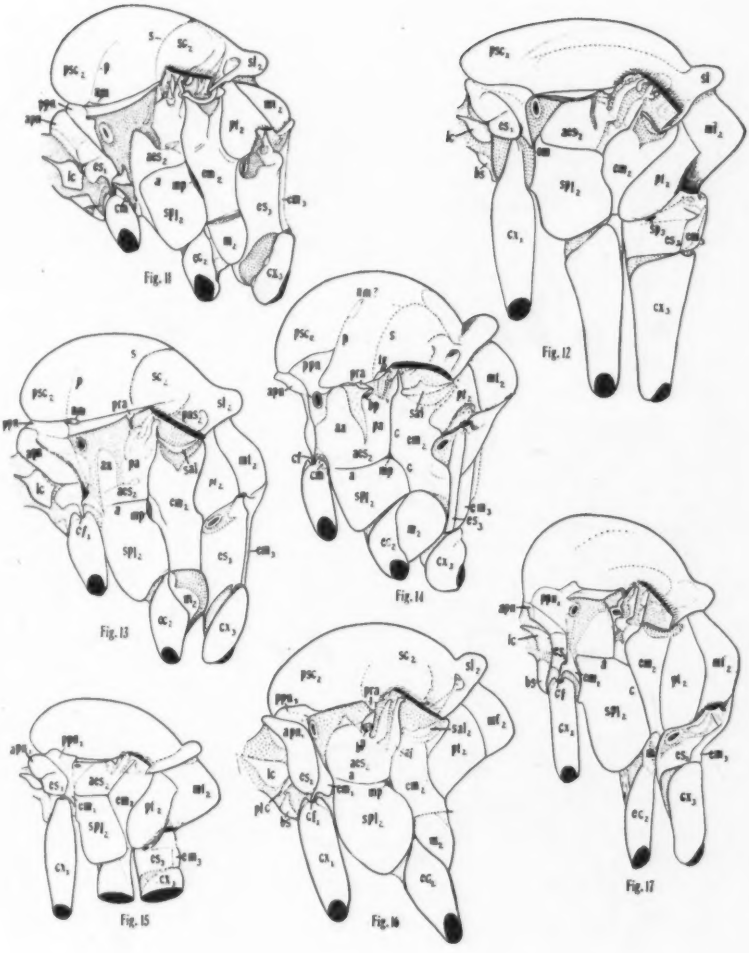


Fig. 11
Fig. 12
Fig. 13
Fig. 14
Fig. 15
Fig. 16
Fig. 17

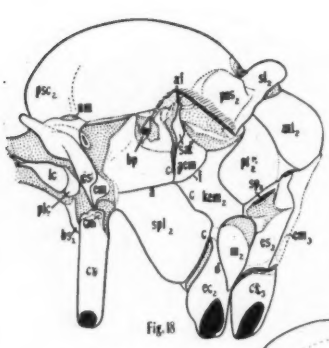


Fig. 18

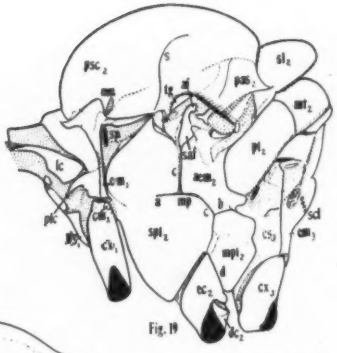


Fig. 19

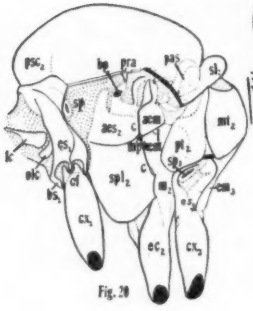


Fig. 20

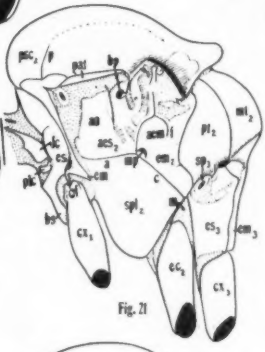


Fig. 21

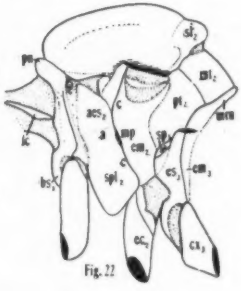


Fig. 22

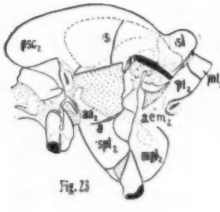


Fig. 23

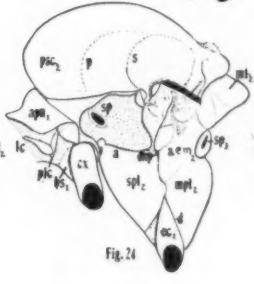


Fig. 24

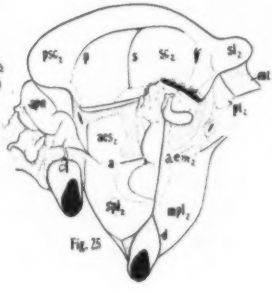


Fig. 25

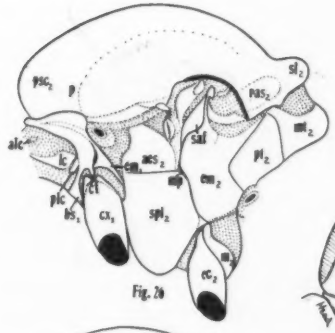


Fig. 26

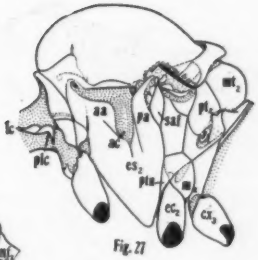


Fig. 27

Fig. 28

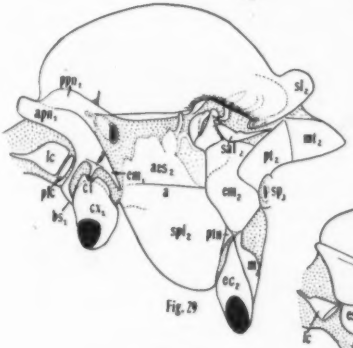


Fig. 29

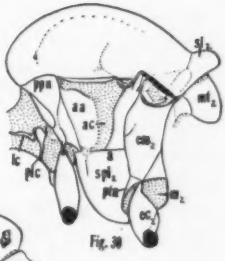


Fig. 30

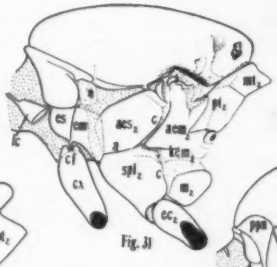


Fig. 31

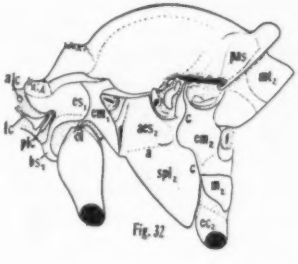


Fig. 32

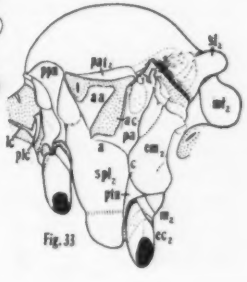


Fig. 33

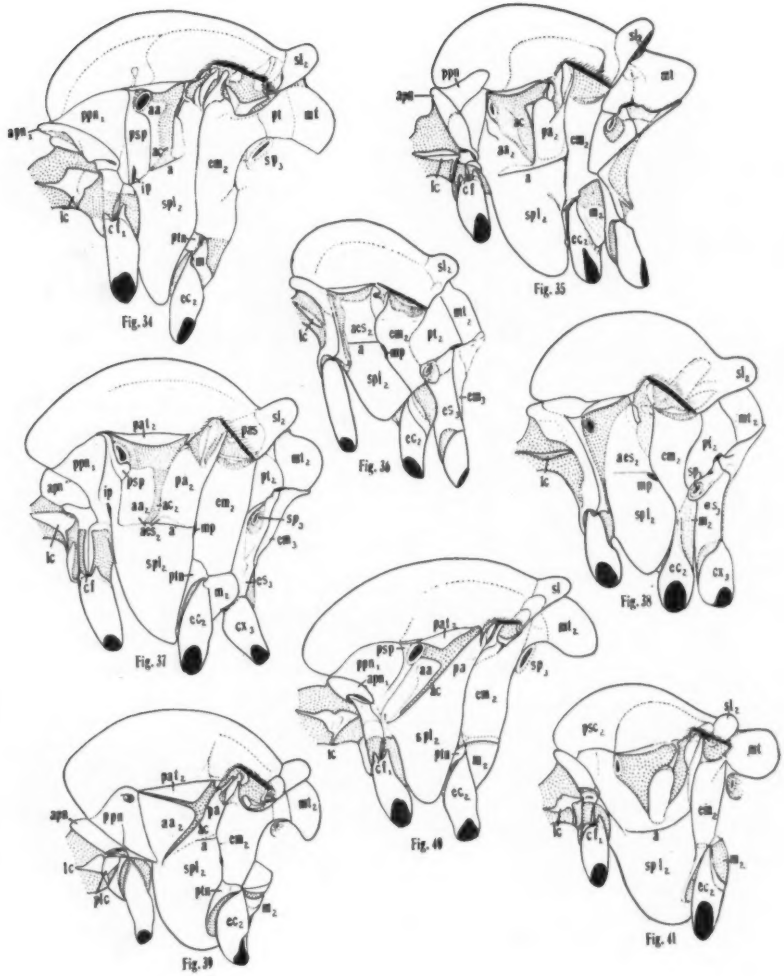


Fig. 34
Fig. 35
Fig. 36
Fig. 37
Fig. 38
Fig. 39
Fig. 40
Fig. 41

THE TYPES OF HESPERIOID GENERA

A. W. Lindsey
Denison University, Granville, Ohio

A growing discontent with unstable generic names has been manifesting itself among entomologists in recent years, and a number of useful papers fixing the types of genera in various groups has been the result. It is to be hoped that the idea will be carried out to the final inclusion of all generic names. It is also to be hoped, but perhaps vainly, that some common basis of treatment may be agreed upon, especially between the systematists of Europe and North America. Our European colleagues unfortunately persist in the use of minor so-called restrictions in the selection of logotypes, although the International rules do not permit such usage, and logical thinking forbids it in so many cases as to leave it a very weak method indeed.

The writer's attitude to the adoption of the International Rules has already been explained.* With this foundation the investigation of the Hesperioid genera has been carried through during the past seven years to its present state of completeness. It is merely an historical review such as that presented by Scudder† for the genera of butterflies, but experience has demonstrated that a complete study of genera of any large and well defined group is not only useful, but likely to weed out errors which may escape notice in studies of limited faunæ or subdivisions of the group.

The method used to attain accuracy in this work has involved several steps. First, the original reference has been examined by the writer in person wherever possible. Failing this, notes have been submitted to friends having access to the original references. Professor H. F. Wickham, Mr. Wm. Schaus, Mr. L. L. Buchanan, and Mr. F. H. Benjamin have given assistance of this kind which the writer acknowledges with thanks. In the case of some rare old books which are even yet unavailable, Scudder's data on the contents of the original have been accepted†. In fixing the types of genera not definitely restricted

* Barnes and Lindsey, Ann. Ent. Soc. Am., XV, 89 *et seq.*, 1922.

† Scudder, Historical Sketch of the Generic Names Proposed for Butterflies. Proc. Am. Acad. Arts and Sci., X, 91-293, 1875.

by the original reference, the International Rules have been rigidly followed. The effort expended in this and similar studies is a reasonable guarantee that no fixations accepted as valid under these rules have been overlooked. The one important disputed work in this connection is Lamarck's Systeme des Animaux sans Vertebres, 1801, in which examples of the various genera are mentioned. It has been argued that Lamarck did exactly the same as Latreille, whose fixations are accepted, but Latreille stated that he was citing types, while Lamarck did not; the International Rules definitely distinguish between such cases. For greater certainty the question has been taken up with a number of our leading authorities on nomenclature and all agree that Lamarck's action is not to be construed as valid type fixation. The question is important in this superfamily because the correct fixation of the type of Hesperia hinges upon it.

Four terms used to designate genotypes fixed in different ways have been borrowed from Van Duzee's Catalogue of the Hemiptera. They are as follows:

Orthotype: A type designated in the original description.

Haplotype: Type by single reference (only included species).

Logotype: Type by designation subsequent to the original description.

Pseudotype: Erroneous type designation.

To these may be added one new term:

Diatype: Type of a genus substituted for a homonym.

No effort has been spared to include in this paper every genus ever proposed for an Hesperioid, and even those names are included which have at some time been incorrectly used as Hesperioid genera. The Zoological Record for 1920 is the latest compilation consulted, but the writer has included all genera published in American periodicals up to the date of writing (August, 1923). Information regarding any omissions which readers may note will be gratefully received.

As a final step, all names have been checked by Scudder's Nomenclator Zoologicus and the two Zoological Indices to determine their validity. Only original spelling and valid emendations are listed. Preoccupied names are marked ‡, and clerical errors §.

NOTE. Since the completion of the manuscript of this paper two more volumes of the Zoological Record have appeared, in which no new genera are listed, and two new genera have been published in American periodicals not yet summarized in the Record. These two are being added to this paper. A. W. Lindsey, Feb., 1925.

ABARATHA — Orthotype *Pterygospidea ransonnettii* Feld.
1881, Moore, Lep. Cey. I, 181.

ABLEPSIS — Orthotype *Oileides vulpinus* Hbn.
1893, Watson, Proc. Zool. Soc. Lond. 1893, 36.

ABRAXIMORPHA — Orthotype *Pterygospidea davidii* Mab.
1897, Elwes and Edwards, Trans. Zool. Soc. Lond. xiv, 123. The statement that "this generic name is proposed for *Ptyergospidea davidii* Mab." is the basis for this citation. If not an orthotype, the same species is an haplotype.

ACALLOPISTES — Orthotype *Erionota holocausta* Mab.
1896, Holland, Proc. Zool. Soc. Lond. 1896, 95.

ACENTROCNEME — Orthotype *Aegiale kollari* Feld.
1875, Scudder. Hist. Sk. 100 (Felder ms.) Proposed by Felder as a new name for *Aegiale*, q. v. but first published by Scudder.

ACERBAS — Orthotype *Hesperia anthea* Hew.
1895, De Niceville, Jn. Bomb. Nat. Hist. Soc. ix, 381.

ACHALARUS — Orthotype *Papilio lycidas* A. & S.
1872, Scudder, Syst. Rev. 50.

ACHLYODES — Logotype *Papilio busirus* Cram.
1820, Hübner, Verz. bek. Schmett. 107. *Busirus, thraso, fridericus, bucolus.*
1870, Butler, Ent. Mo. Mag. vii, 98. Cites *busirus* as type.
1872, Scudder, Syst. Rev. 50. Also cites *busirus.*
1875, id., Hist. Sk. 100. Claims that Westwood, Gen. Diurn. Lep., restricted the genus, excluding *busirus*, but this was not a valid restriction. Pseudotype *fredericus* (*fridericus*). See *Eantis, Sebaldia* and *Ouleus.*

ACHNA — Diatype *Urbanus vetus phalænoides* Hbn.
1820, Billberg, Enum. Ins. 80. Established for no apparent reason to take the place of *Helias* Fab., q. v.

ACLEROS — Haplotype *Cyclopides leucopyga* Mab.
1885, Mabille, Lep. Madagascar ii, pl. liv. f. 3 and 3a; i, 347, 1887. I find this genus and *Systole* cited under the dates 1885 and 1887. Mr. Buchanan tells me that the introduction to the work is dated 1885 and the cover 1887, and that he is unable to find any other indication of the date of publication. Vol. II, plates, is listed in the Zool. Rec. XXIII for 1886 with the date 1885. The text is listed in Vol. XXIV for 1887. Since the types of both genera are figured the earlier date will probably hold.

‡ACOLASTUS — Orthotype *Goniloba savignyi* Godman.
1872, Scudder, Syst. Rev. 50. See also *Polygonus* and *Nennius.* Preoccupied by *Acolastus* Gerst., 1855, in Coleoptera.

ACROMECIS — Haplotype *Apaustus neander* Plötz.
1904, Mabille, Gen. Ins. xvii, 171.

ACTINOR — Orthotype *Halpe radians* Moore.
1893, Watson, Proc. Zool. Soc. Lond. 1893. 108.

ADOPÆA — Haplotype *Papilio thaumas* Hufn.
1820, Billberg, Enum. Ins. 81. *Linea* (*thaumas*) and a ms. species only, *fide* Scudder.

ADOPÆOIDES — Orthotype *Ancyloxypha simplex* Feld.
1900, Godman, Biol. Cent. Am. Rhop. ii, 471.

AEGIALE — Haplotype *Aegiale kollari* Feld.
1860, Felder, Wien. Ent. Monatschr. iv, 110.
1875, Scudder, Hist. Sk. 103, states that this name is too close to *Aegiala* Latr., but it is not a homonym according to present rules. See *Acentrocneme.*

AELLA — Haplotype *Pamphila dryops* Mab.
1904, Mabille, Gen. Ins. xvii, 140.

AEROMACHUS — Orthotype *Thanaos stigmata* Moore.
1890, De Niceville, Jn. Bomb. Nat. Hist. Soc. 214.

AETHEIUS Logotype *Papilio archytas* Stoll.
1820, Hübner, Verz. bek. Schmett. 109. *Archytas, pretus,* and *meris.*
1875, Scudder, Hist. Sk. 104 fixes type.

AETHILLA Haplotype, *Aethilla eleusinia* Hew.
1868, Hewitson, Desc. Hesp. ii, 55.

AGARA Haplotype *Tamyris pardalina* Feld.
1908, Mabille and Boullet, Ann. Sci. Nat. Zool. (ix), vii, 1908.

AIDES Logotype *Papilio epitus* Cramer.
1820, Billberg, Enum. Ins. 81, *epithus* (*epitus*) *phocas* and *proteus.*
1875, Scudder, Hist. Sk. 106. Says that it is preoccupied through *Aidos* and does not cite a type.
1893, Watson, Proc. Zool. Soc. Lond. 1893, 130. Cites *epitus* as type.

ALERA Haplotype *Alera furcata* Mab.
1891, Mabille, C. R. Soc. Ent. Belg. xxxv, p. lxxxiv.

ALLORA Orthotype *Ismene doleschalli* Feld.
1914, Waterhouse and Lyell, Butt. Aust. 215.

AMBLYSCIRTES Orthotype *Hesperia vialis* Edwards.
1872, Scudder, Syst, Rev. 54.

AMENIS Orthotype *Pyrrhopyga pionia* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 1893, 12.

AMPITTIA Orthotype *Hesperia maro* Fab.
1881, Moore, Lep. Ceylon, i, 171.

‡ANAPERUS Diatype *Eudamus caicus* H.-S.
1916, Mabille and Boullet, Ann. Sci. Nat., Zool. (x), Vol. , 232. Preoccupied by *Anaperus* Trosch., Ech, 1846. *Phædinus* G. & S., for which this was established, is not preocupied as stated, so far as I can determine.

ANASTRUS Haplotype *Anastrus obscurus* Hbn.
1822–26, Hübner, Exot., Schmett. ii, 149.
1875, Scudder, Hist. Sk. 111, cites *corbulo* Cr. (*obscurus*) as type, but they are not now regarded as synonymous.

ANATRYTONE Orthotype *Pamphila delaware* Edw.
1905, Dyar, Jn. N. Y. Ent. Soc. xiii, 140.

ANCISTROCAMPTA Haplotype *Ancistrocampta syllius* Feld.
1862, Felder, Wien. ent. Monatschr. vi, 183. *Syllius,* the sole species, has been treated as a synonym of *hiarbas* Cr. There is some doubt of the accuracy of this synonymy, and *hiarbas* is usually applied to a different species, so that the actual standing of *Ancistrocampta* is indefinite.

ANCISTROIDES Orthotype *Ancistroides longicornis* Butl.
1874, Butler, Trans. Ent. Soc. Lond. 1874, 436.

ANCYLOXYPHA Orthotype *Hesperia numitor* Fab.
1862, Felder, Verh. z.-b. Ges. Wien. xii, 477, (5).

ANDRONYMUS Orthotype *Pamphila philander* Pl.
1896, Holland, Proc. Zool. Soc. Lond. 1896, 80.

ANISOCHORIA Logotype *Anisochoria polysticta* Mab.
1876, Mabille, Bull. Soc. Ent. France (5) vi, p. cci. *Polysticta* and *oligosticta.*
1893, Watson, Proc. Zool. Soc. Lond. 1893, 44 and 59. Fixes type.

ANISYNTA Orthotype *Cyclopides cynone* Hew.
1911, Lower, Trans. Roy. Soc. S. Australia 1911, 141.

ANTHOMASTER Orthotype *Hesperia leonardus* Harris
1872, Scudder, Syst. Rev. 57.

ANTIGONUS Logoytpe *Urbanus vetus erosus* Hbn.
1820, Hübner, Verz. bek. Schmett. 108. *Ustus* and *erosus.*
1862, Felder, Wien. ent. Monatschr. vi, 185 (43), used *nearchus* Latr. (*ustus* Geyer) as haplotype of *Chætoneura,* thus fixing the type of *Antigonus* as *erosus,* according to the International Rules (Opinion 6).
1870, Butler, Ent. Mo. Mag. vii. Pseudotype *ustus* (*nearchus*). The genus has since been used in this sense, but incorrectly.

APALLAGA Haplotype *Apallaga separata* Strand.
1911, Strand, Ent. Rundsch. xxviii, 143.

APAUSTUS Haplotype *Papilio menes* Cram.
1820, Hübner, Verz. bek. Schmett. 113.

APOSTICTOPTERUS Haplotype *Apostictopterus fuliginosus* Leech.
1894, Leech, Butt. China etc., 630.

APYRROTHRIX Orthotype *Erycides araxes* Hew.
1921, Lindsey, Hesp. N. A. 15.

ARDARIS Orthotype *Pyrrhopyga eximia* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 1893, 13.

ARGOPTERON Orthotype *Syrichthus aureipennis* Blanch.
1893, Watson, Proc. Zool. Soc. Lond. 1893, 88.

ARNETTA Orthotype *Isoteinon atkinsoni* Moore.
1893, Watson, Proc. Zool. Soc. Lond. 1893, 81.

AROTIS Haplotype *Arotis sirene* Mab.
1904, Mabille, Gen. Ins. xvii, 151.

ARTEUROTIA Orthotype *Arteurotia tractipennis* B. & D.
1872, Butler & Druce, Cist. Ent. i, 112.

ARTINES Orthotype *Thracides æpitus* Geyer.
1901, Godman, Biol. Cent. Am., Rhop. ii, 608.

ARTITROPA Orthotype *Pamphila erinnys* Trim.
1896, Holland, Proc. Zool. Soc. Lond. 1896, 92.

ARUNENA Orthotype *Arunena nigerrima* Swinhoe.
1919, Swinhoe, Ann. & Mag. Nat. Hist. (ix), iii, 317.

ASBOLIS Logotype *Goniloba sandarac* H.-S.
1904, Mabille, Gen. Ins. xvii, 134. *Sandarac* H.-S. and *gagatina* Mab. I have found no published type fixation.

ASTICTOPTERUS Logotype *Astictopterus jama* Felder.
1860, Felder, Wien, ent. Monatschr. iv, 401. *Jama* and *sindu*.
1870, Butler, Ent. Mo. Mag. vii, 95. Cites *jama* as type.

ASTRAPTES Logotype *Papilio aulestes* Cram.
1820, Hübner, Verz. Bek. Schmett. 103. *Aulestes* and eight others.
1875, Scudder, Hist., Sk. 122. Cites *aulestes* as type.

ASTYCUS Logotype *Papilio augias* Linn.
1825, Hübner, Cat. Franck 85. Twenty-two species, including *augias*, according to Scudder. I have been unable to secure data from any other source.
1875, Scudder, Hist. Sk. 122, Cites *augias* as type. Apparently this action will hold, and the genus will replace *Telicota*.

ATALOPEDES Orthotype *Hesperia huron* Edw.
1872, Scudder, Syst. Rev. 57.

ATARNES Haplotype *Leucochitonea sallei* Feld.
1897, Godman & Salvin, Biol. Cent. Am., Rhop. ii, 443.

ATE Orthotype *Papilio jovianus* Cram.
1895, Godman & Salvin, Biol. Cent. Am., Rhop. ii, 401. See *Pythonides* Hbn.

ATRYTONE Orthotype *Hesperia iowa* Scud. (*arogos*).
1872, Scudder, Syst. Rev. 56.

ATRYTONOPSIS Orthotype *Hesperia deva* Edw.
1900, Godman, Biol. Cent. Am., Rhop. ii, 497.

AUBERTIA Logotype *Aubertia dulcis* Obth.
1896, Oberthür, Etudes Ent. xx, 40. *Dulcis* and four others. *Dulcis* may be taken as type.

AUGIADES Logotype *Papilio crinisus* Cram.
1820, Hübner, Verz. bek. Schmett. 112. *Sylvanus, crinisus* and others.
1870, Butler, Ent. Mo. Mag. vii, 58. Cites *crinisus* as type.
1872, Scudder. Syst. Rev. 58. Discards Butler's fixation because of a supposed "restriction" by Stephens and cites *sylvanus*. The genus has since been used in this sense.
1875, id., Hist. Sk. 124. Follows previous course. With *crinisus* as type, it will replace *Lignyostola* Mab. according to the treatment in the Biologia.

AUTOCHTON — Haplotype *Autochton itylus* Hbn.
1823, Hübner, Zutrage ii, 13, pl. 44, ff. 249, 250.

AZONAX — Orthotype *Myscelus typhaon* Hew.
1893, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 267.

BADAMIA — Orthotype *Papilio exclamationis* Fab.
1881, Moore, Lep. Ceylon i, 156.

BAORIS — Orthotype *Hesperia oceia* Hew.
1881, Moore, Lep. Ceylon i, 165.

BARACUS — Orthotype *Isoteinon vittatus* Feld.
1881, Moore, Lep. Ceylon i, 162.

BARCA — Diatype *Dejeania bicolor* Obth.
1902. De Niceville, Jn. Bomb. Nat. Hist. Soc. xiv, 251. New name for ‡*Dejeania* Obth.

(BATTUS — Logotype *Papilio polydamas* Linn.
1777, Scopoli, Introd. 433. *Polydamas* and many others, very heterogeneous, *fide* Scudder.
1858, Rambur, Cat. Lep. Andal. 85. Uses for *sao*, *fide* Scudder, who says also that *sao* was not originally included.
1876, Mabille, Ann. Soc. Ent. France, 254 and 257, uses for *sao*, *orbifer*, *therapne*, *poggei* and *phlomidis*.
Apparently no type has ever been cited, so the best disposal of the name seems to be as a synonym of *Papilio* with *polydamas* as type, thus removing it from the Hesperioidea, where it would be the oldest name of all.)

BIAKA — Orthotype *Biaka albidiscus* J. & T.
1917, Joicey and Talbot, Ann. & Mag. Nat. Hist. (8), xx, 225.

BIBASIS — Orthotype *Goniloba sena* Moore.
1881, Moore, Lep. Ceylon i, 160.

BIBLA — Haplotype *Hesperia papyria* Bdv.
1904, Mabille, Gen. Ins. xvii, 122.

BOLLA — Logotype ——— *pullata* Mab.
1903, Mabille, Gen. Ins. xvii, 72. *Pullata* and seventeen other species.
1921, Lindsey, Hesp. Am. 43. Cites *pullata* as type.

BRACHYCORYNE — Haplotype *Papilio flyas* Cram.
1883, Mabille, C. R. Soc. Ent. Belg. p. liii. Professor Wickham tells me that the only reference which he is able to find is a statement of comparison: "statura *Brachycorynæ flyadis* Cram." This would suggest the nominative form *Brachycoryna*, already used in the order Coleoptera according to the Nomenclator Zoologicus, but Mabille later uses the genus with the final e.
1903, Mabille, Gen. Ins. xvii, 81.

‡BREMERIA — Logotype *Syrichtus bieti* Obth.
1906, Tutt, Brit. Butt. i, 296. *Bieti*, *maculatus* and *oberthuri*.
1921, Lindsey, Hesp. Am. 37. Cites *bieti* as type.
Preoccupied by *Bremeria* Alpheraky, 1892, and *Bremeria* Moore, 1896. Since Tutt's subdivisions of *Hesperia* have not been generally adopted it seems useless to propose a substitute name.

BRONTIADES — Logotype *Papilio procas* Cram.
1820, Hübner, Verz. bek. Schmett. 113. *Procas*, *gentius*, *menalcas*, *petrus*.
1870, Butler, Ent. Mo. Mag. vii, 94. Cites *procas* as type. According to Mabille this species is a synonym of *julettus*, type of *Cabirus*.

BUNGALOTIS — Orthotype *Papilio midas* Cram.
1893, Watson, Proc. Zool. Soc. Lond. 1893, 28.

BURARA — Logotype *Ismene vasutana* Moore.
1893, Swinhoe, Trans. Ent. Soc. Lond. 1893, 329. *Vasutana*, *harisa*, *gomata*.
1894, Sharp, Zool. Rec. xxx, 236 does not fix type.

BUTLERIA — Logotype *Carterocephalus exornatus* Feld.
1871, Kirby, Syn. Cat. 624. *Polyspilus, exornatus* and others.
1873, id. Zool. Rec. viii, 365. Cites *exornatus* as type.
1893, Watson, Proc. Zool. Soc. Lond. 1893, 79. Cites *valdivianus* Phil. (*exornatus*) as type.

BUZYGES — Haplotype *Buzyges idothea* Godman.
1900, Godman, Biol. Cent. Am., Rhop. ii, 497.

CABARES — Orthotype *Thanaos potrillo* Lucas.
1894, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 337.

CABIRUS — Logotype *Papilio julettus* Stoll.
1820, Hübner, Verz. bek. Schmett. 102. *Linus* and *julettus*.
1872, Scudder, Hist. Sk. 129. Says that *linus* is not a butterfly and cites *julettus* as type.
See *Brontiades*.

‡CAECINA — Logotype *Caecina calathana* Hew.
1868, Hewitson, Desc. Hesp. ii, 55. *Calathana* and *compusa*.
1893, Watson, Proc. Zool. Soc. Lond. 1893, 19. Cites *calathana* as type.
Preoccupied by *Caecina* Stal, Hemiptera, 1863. See *Ocyba*.

CAENIDES — Logotype *Hesperia dacela* Hew.
1896, Holland, Proc. Zool. Soc. Lond. 1896, 85. Eighteen species and a nineteenth with question, of which *dacela* may be taken as type.

CALLIADES — Logotype *Eudamus phrynicus* Hew.
1912, Mabille and Boullet, Ann. Sci. Nat. Zool. (ix), xvi, 108. *Phrynicus, polias* and *rhacoces*. The first may be taken as type.

CALLIANA — Haplotype *Calliana pieridoides* Moore.
1878, Moore, Proc. Zool. Soc. Lond. 1878, 686.

CALLIMORMUS — Orthotype *Callimormus juventus* Scud.
1872, Scudder, Syst. Rev. 53.

CALPODES — Logotype *Papilio ethlius* Cram.
1820, Hübner, Verz. bek. Schmett. 107. *Forulus* and *ethlius*.
1872, Scudder, Syst. Rev. 61. Cites *ethlius* as type.

CALTORIS — Logotype *Hesperia kumara* Moore.
1893, Swinhoe, Trans Ent. Soc. Lond. 1893, 323. *Kumara* and twelve others.
1897, Elwes and Edwards, Trans. Zool. Soc. Lond. 270. Sink in *Parnara* without citing a type. *Kumara* may be regarded as the type.

CAMPTOPLEURA — Logotype *Camptopleura theramenes* Mab.
1877, Mabille, Pet. Nouv. Ent. ii, 166. *C. theramenes* alone described, but *thrasybulus* also definitely referred to the genus and cited "Campt. Thrasybuli" in the description of *theramenes*.
1879, Kirby, Zool. Rec. xiv, 139. Cites *theramenes* as type.
1893, Watson, Proc. Zool. Soc. Lond. 1893, 55. Cites *theramenes* as type.

CAPILA — Haplotype *Ismene jayadeva* Moore.
1866, Moore, Proc. Zool. Soc. Lond. 1865, 785.

CAPRONA — Haplotype *Caprona pillaana* Wlgr.
1857, Wallengren, Rhop. Caffr. 51.

CARCHARODUS — Logotype *Papilio lavaterœ* Esp.
1820, Hübner, Verz. bek. Schmett. 110. *Lavatherœ* (!) *altheœ* and *malvœ*.
1875, Scudder, Hist. Sk. 134. Cites no type, but says that the genus falls before *Urbanus*.
1893, Watson, Proc. Zool. Soc. Lond. 1893, 44. Cites *lavaterœ* as type.

CARRHENES — Logotype *Leucochitonea fuscescens* Mab.
1895, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 388. Six species of which the first may be taken as type.

CARTEROCEPHALUS — Diatype *Papilio jacchus* Fab.
1852, Lederer, Verh. z. b. Ges. Wien ii, 26, 49. Included *paniscus, sylvius* and *argyrostigma, fide* Scudder, and was established to take the place of

‡*Steropes* Bdv., although none of these species were included in *Steropes* by Boisduval.

1867, Snellen, Vlind. Ned. 83. Pseudotype *paniscus, fide* Scudder.
1870, Butler, Ent. Mo. Mag. vii, 96. Pseudotype *exornatus* Feld.
1875, Scudder, Hist. Sk. 134. Apparently bases the genus on its included species, and not on the identity of *Steropes*, with which it must be held identical, since it was proposed as a substitute name. Scudder thus regards it as identical with his *Pamphila*, pseudotype *palaemon*, and it has since been used in this sense.
1916, Barnes and McDunnough, Contributions iii, 124. Use the genus for *palaemon*, erroneously.
1921, Lindsey, Hesp. Am. 57. Follows the same course.
See *Steropes* and *Pamphilida*.

CARYSTUS Logotype *Papilio jolus* Cram.
1820, Hübner, Verz. bek. Schmett, 114. *Jolus, hylaspes, phyllus* and *abebalus*.
1870, Butler, Ent. Mo. Mag. vii, 92. Cites *jolus* as type.

CARYSTOIDES Haplotype *Hesperia basochesii* Latr.
1901, Godman, Biol. Cent. Am. Rhop. ii, 611.

CASYAPA Diatype *Chaetocneme corvus* Feld.
1871, Kirby, Syn. Cat. 576. New name for *Chaetocneme* Feld., said to be preoccupied.

CATIA Orthotype *Hesperia drury* Latr.
1900, Godman, Biol. Cent. Am., Rhop. ii, 481.

CATODAULIS Haplotype *Pyrgus tethys* Men.
1878, Speyer, Stett. ent. Zeit. xxxix, 179. See *Daimio*.

‡CECROPS Haplotype *Cecrops zarex* Hbn.
1818, Hübner, Zutrage, pl. 32, ff. 183, 184. Preoccupied by *Cecrops* Leach, Crust., 1813. See *Cecropterus*.

CECROPTERUS Diatype *Cecrops zarex* Hbn.
1869, Herrich-Schaeffer, Corr-Blatt Regensb. xxiii, 131. New name for *Cecrops*.

CELAENORRHINUS Logotype *Papilio eligius* Cram.
1820, Hübner, Verz. bek. Schmett. 106. *Corbulo, niso, eligius*, etc.
1875, Scudder, Hist. Sk. 137. Cites *eligius* as type.

CELOTES Haplotype *Pholisora nessus* Edw.
1899, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 452.

CEPHRENES Diatype *Corone ismenoides* Mab.
1914, Waterhouse and Lyell, Butt. Aust. 206. New name for ‡*Corone* Mab. *Sperthias* Feld (*ismenoides* Mab.) cited as type.

CERATRICHIA Orthotype *Papilio nothus* Fab.
1869, Butler, Cat. Lep. Fab. 274.

CHAEREPHON Orthotype *Pamphila citrus* Mab.
1900, Godman, Biol. Cent. Am., Rhop. ii, 474.

CHAETOCNEME Logotype *Chaetocneme corvus* Feld.
1860, Felder, Sitzungsb. Acad. Wien xl, 460. *Corvus* cited as type.
1870, Butler, Ent. Mo. Mag. vii, 57. Cites *corvus* as type.
1875, Scudder, Hist. Sk. 139. Says that it is preoccupied by *Chaetocnema* Steph. in the Coleoptera. The International Rules permit the use of both, although such close orthography is not desirable. See *Casyapa*.

CHAETONEURA Haplotype *Chaetoneura hippulus* Feld.
1862, Felder, Wien. ent. Monatschr. vi, 185. *Hippulus* (*nearchus* Latr.) sole species.
1875, Scudder, Hist. Sk. 139. Says that the genus falls before *Àntigonus* Hbn. with the same type, but this is not the case according to present usage. See *Antigonus*.

CHAPRA Orthotype *Hesperia mathias* Fab.
1881, Moore, Lep. Ceylon i, 169.

CHARIDIA Haplotype *Leucochitonea lucaria* Hew.
1903, Mabille, Gen. Ins. xvii, 73.

CHARMION Orthotype *Hesperia ficulnea* Hew.
1894, De Niceville, Jn. As. Soc. Beng. lxiii, 48.

CHIOIDES Orthotype *Eudamus albofasciatus* Hew.
1921, Lindsey, Hesp. Am. 25.

CHIOMARA Orthotype *Achlyodes mithrax* Mösch.
1899, Godman and Salvin, Biol. Cent. Am. Rhop. ii, 453. Says that the genus is erected for this species, which may be regarded as a type designation.

CHIONEIGIA Orthotype *Chioneigia leggei* Heron.
1909, Heron, Trans. Zool. Soc. Lond. xix, 172.

CHLŒRIA Haplotype *Hesperia psittacina* Feld.
1904, Mabille, Gen. Ins. xvii, 178.

CHOASPES Orthotype *Thymele benjamini* Guer.
1881, Moore, Lep. Ceylon i, 158.

CHONDROLEPIS Haplotype *Pamphila murga* Mab.
1904, Mabille, Gen. Ins. xvii, 170.

CHORANTHUS Orthotype *Hesperia radians* Lef.
1872, Scudder, Syst. Rev. 58.

‡CHORISTONEURA Haplotype *Choristoneura apicalis* Mab.
1889, Mabille. Bull. Soc. Ent. France (6), ix, p. clvi. Preoccupied by *Choristoneura* Led., Lep., 1859. See *Daratus*.

CHRYSOPLECTRUM Orthotype *Eudamus otriades* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 1893, 24.

COBALOPSIS Orthotype *Pamphila edda* Mab.
1900, Godman, Biol. Cent. Am. Rhop. ii, 537.

COBALUS Logotype *Papilio virbius* Cram.
1820, Hübner, Verz. bek. Schmett. 115. *Virbius* and seven other species.
1870, Butler, Ent. Mo. Mag. vii, 92. Cites *virbius* as type.

COCCEIUS Orthotype *Eudamus pylades* Scud.
1894, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 336.

CODATRACTUS Diatype *Heteropia imitatrix* Mab.
1921, Lindsey, Hesp. N. A. 26. New name for ‡*Heteropia*.

CŒLIADES Logotype *Papilio dubius* Cram.
1820, Hübner, Verz. bek. Schmett. 106, *Forestan, dubius* and *chromus*.
1875, Scudder, Hist. Sk. 145. Cites *dubius* as type.

COGIA Haplotype *Cogia hassan* Butl.
1870, Butler, Trans. Ent. Soc. Lond. 1870, 508.

COLADENIA Orthotype *Plesioneura indrani* Moore.
1881, Moore, Lep. Ceylon, i, 180.

CONOGNATHUS Haplotype *Conognathus platon* Feld.
1862, Felder, Wien. ent. Monatschr. vi, 181. Formerly regarded as preoccupied by *Conognatha* Esch. in the Coleoptera, but it may stand, according to the International Rules. See *Neonoma*.

COPÆODES Logotype *Heteropterus procris* Edw.
1877, Speyer, in Edward's Cat. N. A. Lep. 49. *Procris* and *arene*.
1879, Kirby, Zool. Rec. xiv, 139. Cites *procris* as type.
1893, Watson, Proc. Zool. Soc. Lond. 1893, 97. Follows Kirby.

‡CORONE Logotype *Corone ismenoides* Mab.
1878, Mabille, Pet. Nouv. ii, 205. *Ismenoides, dypnephila* and *niveostriga*.
1880, Kirby, Zool. Rec. xv, 189. Cites *ismenoides* as type.
1893, Watson, Proc. Zool. Soc. Lond. 1893, 130. Also cites *ismenoides*. Preoccupied by *Corone* Kaup., Aves, 1829. See *Cephrenes*.

CRETEUS Orthotype *Hesperia cyrina* Hew.
1895, De Niceville, Jn. Bomb. Nat. Hist. Soc. ix, 385.

CRONIADES Logotype *Pyrrhopyga pieria* Hew.
1903, Mabille, Gen. Ins. xvii, 13. *Pieria* and *machaon*. The former may be taken as type.

CROSSIURA Haplotype *Crossiura pennicillatum* De N.
1892, De Niceville, Jn. Bomb. Nat. Hist. Soc. vii, 350.

CTENOPTILUM Orthotype *Achlyodes vasava* Moore.
1890, De Niceville, Jn. Bomb. Nat. Hist. Soc. 220.

CUPITHA Orthotype *Cupitha tympanifera* Mre. (*purreea* Mre.)
1884, Moore, Jn. As. Soc. Beng. liii, 47 (32).

CYCLOGLYPHA Logotype *Hesperia thrasybulus* Fab.
1903, Mabille, Gen. Ins. xvii, 70. *Thrasybulus and cæruleonigra*. Spelled *Cyclogypha* in text and corrected in errata. *Thrasybulus* may be taken as type.

CYCLOPIDES Logotype *Papilio steropes* D. & S. (*morpheus*).
1820, Hübner, Verz. bek. Schmett. 111. *Steropes* and others.
1870, Butler, Ent. Mo. Mag. vii, 96. Cites *steropes* (*morpheus*) as type.
1872, Scudder, Syst. Rev. 54. Follows Butler.
1875, id., Hist. Sk. 150–151. Says that Butler's action was erroneous, but his reason is unsound according to present rules, and Butler's fixation will stand. Pseudotype *metis*.
1906, Tutt, Brit. Butt. i, 191. Pseudotype *palæmon*. See *Heteropterus*.

CYCLOSEMIA Orthotype *Papilio herennius* Cram.
1878, Mabille, Pet. Nouv. ii, 229.

CYDRUS Haplotype *Cydrus nævolus* Godman.
1900, Godman, Biol. Cent. Am., Rhop. ii, 512.

CYMÆNES Orthotype *Cobalus tripunctus* H.-S.
1872, Scudder, Syst. Rev. 61. Cites *tripunctus* as type.
1901, Godman, Biol. Cent. Am., Rhop. ii, 594. Disregards Scudder's action and uses *Goniloba malitiosa* H.-S. as type. This has fixed the present usage of *Cymænes* erroneously, and a new genus is required for *malitiosa* and its allies. See *Godmania*.

DAIMIO Haplotype *Pyrgus tethys* Men.
1875, Murray, Ent. Mo. Mag. xi, 171.

DALLA Logotype *Cyclopides eryonas* Hew.
1904, Mabille, Gen. Ins. xvii, 107. *Eryonas* and 36 other species.
1921, Lindsey, Hesp. N. A. 58. Cites *eryonas* as type.

DAMAS Haplotype *Goniloba clavus* H.-S.
1901, Godman, Biol. Cent. Am., Rhop. ii, 621.

DARATUS Diatype *Choristoneura apicalis* Mab.
New name for *Choristoneura* Mabille, preoccupied.

DARPA Haplotype *Darpa hanria* Moore.
1865, Moore, Proc. Zool. Soc. Lond. 781.

‡DEJEANIA Haplotype *Dejeania bicolor* Obth.
1896, Oberthür, Etudes d'Ent. xx, 40. Preoccupied in Coleoptera and Diptera. See *Barca*.

DIÆUS Logotype *Leucochitonea lacæna* Hew.
1895, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 413. Two species, of which *lacæna* may be taken as type.
1896, Sharp, Zool. Rec. xxxii, 284. Says "for *Leuchochitonea lacæna*."

‡DICHELURA Haplotype *Dichelura tricuspidata* Mab.
1902, Mabille, Bull. Soc. Ent. France. 179. Preoccupied by *Dichelura* Macq., Diptera (Nom. Zool., no date given). See *Jera*.

DICRANASPIS Haplotype *Papilio idas* Cram.
1878, Mabille, Ann. Soc. Ent. Belg. xxi, 24. See *Proteides*.

DION Orthotype *Carystus gemmatus* Butl.
1901, Godman, Biol, Cent. Am. Rhop. ii, 592.

DIPHORIDAS — Orthotype *Urbanus vetus phalænoides* Hbn.
1896, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 423. See *Helias*.

DIS — Haplotype *Dis annulatus* Mab.
1889, Mabille, Bull. Soc. Ent. France (6), ix, p. clxxxiv.

DISPAR — Orthotype *Telesto compacta* Butl.
1914, Waterhouse and Lyell, Butt. Australia 197.

DOBERES — Haplotype *Helias mexicanus* Feld.
1895, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 407.

DREPHALYS — Orthotype *Eudamus helixus* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 34.

DYSCOPHELLUS — Diatype *Papilio sebaldus* Cram.
1893, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 319. New name for ‡*Dyscophus* Burm.

‡DYSCOPHUS — Orthotype *Papilio sebaldus* Cram.
1878, Burmeister, Desc. Rep. Arg. v, 291. Preoccupied in Reptilia, 1872, and Orthoptera, 1874. See *Dyscophellus*.

DYSENIUS — Orthotype *Erycides albicilla* H.-S.
1872, Scudder, Syst. Rev. 46.

EAGRIS — Haplotype *Hesperia sabadius* Gray.
1863, Guenee, in Maill., Renn. ii, Lep. 19, *fide* Scudder.

EANTIS — Haplotype *Urbanus vetus thraso* Hbn.
1836, Boisduval, Spec. Gen. pl. 13, f. 6.
1895, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 404. Pseudotype *busirus* Cr. See *Achlyodes* and *Sebaldia*.

EBRIETAS — Orthotype *Achlyodes osyris* Staud.
1896, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 418.

ECHELATUS — Logotype *Anastrus varius* Mab.
1894, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 378. Four species, of which the first may be taken as type.

ECTOMIS — Haplotype *Ectomis adoxa* Mab.
1878, Mabille, Ann. Soc. Ent. Belg. xxi, 31.

EETION — Orthotype *Hesperia elia* Hew.
1895, De Niceville, Jn. Bomb. Nat. Hist. Soc. ix, 395.

ENOSIS — Logotype *Enosis dognini* Mab.
1889, Mabille, Bull. Soc. Ent. France (6), ix, p. x. *Dognini* and three other species.
1893, Watson, Proc. Zool. Soc. Lond. 130. Cites *dognini* as type.

ENTHEUS — Haplotype *Papilio peleus* Linn.
1820, Hübner, Verz. bek. Schmett. 114. See *Peleus* and *Phareas*.

EOGENES — Haplotype *Pamphila alcides* H.-S.
1909, Mabille, Seitz's Grossschm. der Erde pt. i, vol. i, p. 349.

EPARGYREUS — Logotype *Papilio tityrus* Fab.
1820, Hübner, Verz. bek. Schmett. 105, *Prodicus*, *clarus* etc.
1872, Scudder, Syst. Rev. 49. Cites *tityrus* (*clarus*) as type.

‡EPEUS — Haplotype *Epeus veleda* Godman.
1901, Godman, Biol. Cent. Am., Rhop. ii, 601. Preoccupied by *Epeus* Kuwert, 1896. See *Eprius*.

EPHYRIADES — Logotype *Papilio otreus* Cram.
1820, Hübner, Verz. bek. Schmett. 111. *Otreus*, *folus*, *tryxus*, *asychis*.
1875, Scudder, Hist. Sk. 164. Cites *otreus* as type.

EPINOSIS — Orthotype *Pamphila angularis* Mösch.
1913, Schaus, Proc. Zool. Soc. Lond. 366.

EPIPHYES — Orthotype *Pamphila carolina* Skinner.
1905, Dyar, Jn. N. Y. Ent. Soc. xiii, 132.

EPRIUS — Diatype *Epeus veleda* Godman.
1901, Godman, Biol. Cent. Am., Rhop. ii, 741. New name for ‡*Epeus*.

ERACON — Logotype *Arteurotia biternata* Mab.
1894, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 365. *Biternata* and *bufonia*. The former may be taken as type.
1895, Sharp, Zool. Rec. xxxi, 264. Says for *biternata*.

ERETIS — Haplotype *Eretis melania* Mab.
1891, Mabille, C. R. Soc. Ent. Belg. xxxv, p. lxxi.

ERIONOTA — Logotype *Papilio thrax* Linn.
1878, Mabille, Ann. Soc. Ent. Belg. xxi, 34. *Thrax*, *hypœpa* and *irava*.
1893, Watson, Proc. Zool. Soc. Lond. 72. Cites *thrax* as type.

‡EROPUS — Haplotype *Antigonus ægides* H.-S.
1896, Godman and Salvin, Biol. Cent. Am., Rhop. iii, pl. 88, ff. 27, 28, 29. Preoccupied in Coleoptera by Simon and renamed by Godman and Salvin simultaneously with its publication. See *Theagenes*.

ERYCIDES — Logotype *Papilio pygmalion* Cram.
1820, Hübner, Verz. bek. Schmett. 110. *Pigmalion* and *megalesius*.
1872, Scudder, Syst. Rev. 46. Cites *pygmalion* (*pigmalion*) as type.

ERYNNIS — Logotype *Papilio tages* Linn.
1801, Schrank, Fauna Boica ii, i, 157. *Malvæ*, *fritillum*, *tages*, *comma*, *linea*, *speculum*.
1872, Scudder, Syst. Rev. 50. Cites *tages* as type.
1875, Id., Hist. Sk. 168. Repudiates his former action and cites *comma* as type.
1906, Tutt. Brit. Butt. i, 218. Pseudotype *alceæ* (*malvæ*). This fixation could not hold in any case, since it is based on a misidentification and cites a name not included.
1916, Barnes and McDunnough, Contr., iii, 125. Follow Tutt.
1922, Barnes and Lindsey, Ann. Ent. Soc. Am. xv, 94. Consider this history and cite *tages* as type. According to the International Rules, none of the restrictions used in arriving at the conclusion that *comma* or *alceæ* is type are valid. Scudder's first fixation is valid, however, and the genus will therefore take the place of *Thanaos*. See *Thymele*.

EUDAMIDAS — Logotype *Papilio melander* Cram.
1895, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 386. The first species may be taken as type.

EUDAMUS — Orthotype *Papilio proteus* Linn.
1832–3, Swainson, Zool. Ill., ii, 48.

EUPHYES — Orthotype *Hesperia metacomet* Harris.
1872, Scudder, Syst. Rev. 59.

EUROTO — Orthotype *Pamphila compta* Butler.
1900, Godman, Biol. Cent. Am. Rhop. ii, 549.

‡EURYPTERUS — Logotype *Eurypterus gigas* Mab.
1877, Mabille, Pet. Nouv. ii, 162. *Gigas*, *coracina*, and *lavochrea*.
1879, Kirby, Zool. Rec. xiv, 139. Cites *gigas* as type.
1893, Watson, Proc. Zool. Soc. Lond. 37. Cites *gigas* as type and refers the genus doubtfully to *Aethilla*. Preoccupied by *Eurypterus*, De Kay, Crust., 1826.
Mabille and Boullet follow Watson's disposal of the genus; so a new name is apparently unnecessary.

EUSCHEMON — Haplotype *Euschemon rafflesia* Dbld.
1846, Doubleday, in Stoke's Austr. i. App. 513. (*fide* Scudder).

EUTHYMELE — Logotype *Hesperia mercatus* Fab.
1878, Mabille, Ann. Soc. Ent. Belg. xxi, 24. One of three groups into which he divides *Thymele*. Included *aulestes* Cram., *apastus* Cram., *mercatus* Fab. (*fulgerator Cram.*) and *alardus* Stoll, *fide* Wickham.
1893, Watson, Proc. Zool. Soc. Lond. 26. States that no type was specified, and places the genus under *Thymele*. It seems that the best course is to cite *mercatus*, a synonym of *fulgerator* Walch, as type, so that the genus will replace *Thymele* Auct. if needed. See *Astraptes* and *Thymele*.

EUTHYMUS Orthotype *Papilio phylaeus* Dru.
1872, Scudder, Syst. Rev. 57. See *Hylephila*.

EUTOCUS Orthotype *Eutocus phthia* Godman.
1901, Godman, Biol. Cent. Am., Rhop. ii, 599.

EUTYCHIDE Orthotype *Hesperia physcella* Hew.
1900, Godman, Biol. Cent. Am., Rhop. ii, 544.

EXOMETOECA Haplotype *Exometoeca nycteris* Meyr.
1887, Meyrick, Proc. Linn. Soc. N. S. W. (2), ii, 833.

FALGA Orthotype *Carystus jeconia* Butl.
1897, Mabille, Ann. Soc. Ent. France, lxvi, 211. "Established for *Carystus jeconia* Butl."

FAVRIA Orthotype *Hesperia cribrellum* Evers.
1906, Tutt, Brit. Butt. i, 218.

FLACCILLA Orthotype *Papilio aecas* Cram.
1901, Godman, Biol. Cent. Am., Rhop. ii, 593.

(FRAENATI
1876, Mabille, Ann. Soc. Ent. France, vi, 274. The name is proposed for a group equivalent to Scudder's Astyci, to include the genus *Euschemon*.
1903, id., Gen. Ins. xvii, 36. The name is cited under *Euschemon*, but apparently is not to be regarded as a genus.)

GALERGA Haplotype *Galerga hyposticta* Mab.
1897, Mabille, Ann. Soc. Ent. France lxvi, 210.

GAMIA Orthotype *Proteides galua* Holland.
1896, Holland, Proc. Zool. Soc. Lond. 84.

GANGARA Orthotype *Papilio thyrsis* Fab.
1881, Moore, Lep. Ceylon i, 164.

GARGA Haplotype *Garga olena* Mab.
1889, Mabille, Le Nat. (2), xi, 216.

GASTROCHAETA Haplotype *Gastrochaeta mabillei* Holland.
1894, Holland, Ent. News v, 28, pl. i, ff. 15, 16.
1896, id., Proc. Zool. Soc. Lond. 37. Describes as new and cites type.

GE Orthotype *Ge geta* De N.
1895, De Niceville, Jn. Bomb. Nat. Hist. Soc. ix, 373.

GECANA Orthotype *Ismene fergussoni* De N.
1912, Swinhoe, Lep. Ind. ix, 230.

GEGENES Logotype *Papilio pygmaeus* Hbn.
1820, Hübner, Verz. bek. Schmett. 107. *Pygmaeus*, *heraldus* and *luridus*.
1870, Butler, Ent. Mo. Mag. vii, 93. Cites *pygmaea* as type.

GEHENNA Orthotype *Hesperia abima* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 108.

GEHLOTA Logotype *Plesioneura sumitra* Mre.
1889, Doherty, Jn. As. Soc. Beng. lviii, 131. *Sumitra*, *leucocera* and *pinwilli* named and "their allies" mentioned.
1890, Sharp, Zool. Rec. xxvi, 228. Says for *sumitra* and allies.
1893, Watson, Proc. Zool. Soc. Lond. 49. Cites *sumitra* as type.

GEROSIS Haplotype *Coladenia hamiltonii* De N.
1903, Mabille, Gen. Ins. xvii, 49.

GINDANES Logotype *Gindanes panaetius* G. & S.
1895, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 415. The first species may be taken as type.

GODMANIA Orthotype *Goniloba malitiosa* H.-S.
1923, Skinner and Ramsden, Proc. Acad. Nat. Sci. Phil. lxxv, 321. To supplant *Cymaenes* Godman, not Scudder.

GOMALIA Haplotype *Gomalia albofasciata* Mre.
1879, Moore, Proc. Zool. Soc. Lond., 114.

GONILOBA Orthotype *Niconiades xanthaphes* Hbn.
1852, Westwood and Hewitson, Gen. Diurn. Lep. ii, 511. *Xanthaphes* is printed in bold faced type, which, with remarks in the introduction, constitutes a type fixation.

GONIURUS Logotype *Papilio simplicius* Stoll.
1820, Hübner, Verz. bek. Schmett, 104. *Simplicius, coelus* and others.
1870, Butler, Ent. Mo. Mag. vii, 56. Cites *simplicius* as type.
1875, Scudder, Hist. Sk. 180, for insufficient reasons discards Butler's fixation and cites *coelus*. This fixed the use of the genus until 1916.
1893, Watson, Proc. Zool. Soc. Lond. 20. Pseudotype *coelus* Cram.
1916, Barnes and McDunnough, Contr. iii, 2. Pointed out the true type.
1922, Skinner and Williams, Trans. Am. Ent. Soc. xlviii, 115, again erroneously cite *coelus*.

GORGOPAS Logotype *Achlyodes viridiceps* B. & D.
1894, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 366. Three species, of which *viridiceps* may be taken as type.
1895, Sharp, Zool. Rec. xxxi, Ins. 264. Says for *viridiceps*.

GORGOPHONE Haplotype *Gorgophone meliboea* G. & S.
1894, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 378.

GORGYRA Orthotype *Apustus aburæ* Plötz.
1896, Holland, Proc. Zool. Soc. Lond. 31.

GORGYTHION Logotype *Helias pyralina* Mösch.
1896, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 424. *Pyralina* and *begga*.

GRAIS Orthotype *Anastrus stigmaticus* Mab.
1894, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 381.

GRANILA Haplotype *Pyrrhopyga paseas* Hew.
1903, Mabille, Gen. Ins. xvii, 11.

GRYNOPSIS Orthotype *Phareas coeleste* Westw.
1893, Watson, Proc. Zool. Soc. Lond. 42.

HAEMACTIS Haplotype *Achlyodes sanguinalis* Westw.
1903, Mabille, Gen. Ins. xvii, 70. Misspelled *Staemactis* in the text and corrected in the errata.

HALLIA Orthotype *Thanaos marloyi* Bdv.
1906, Tutt, Brit. Butt. i, 261. Preoccupied by *Hallia* Edw., Haim. Coel. 1850.

HALOTUS Haplotype *Halotus saxula* Godman.
1900, Godman, Biol. Cent. Am., Rhop. ii, 505.

HALPE Logotype *Halpe ceylonica* Moore.
1878, Moore, Proc. Zool. Soc. Lond. 689. *Beturia, ceylonica* and others.
1879?, Zool. Rec. for 1878, cites *ceylonica* as type.
1893, Watson. Proc. Zool. Soc. Lond. 93. Pseudotype *beturia*.

HANTANA Orthotype *Eudamus infernus* Feld.
1881, Moore, Lep. Cey. i, 179.

HASORA Orthotype *Goniloba badra* Mre.
1881, Moore, Lep. Cey. i, 159.

HEDONE Orthotype *Hesperia brettus* Bdv. and Lec.
1872, Scudder, Syst. Rev. 58.

HELIAS Haplotype *Urbanus vetus phalaenoides* Hbn.
1807, Fabricus, Ill. Mag. vi, 287.
1870, Butler, Ent. Mo. Mag. vii, 98. Cites the type correctly.
1875, Scudder, Hist. Sk. 184. Claims that it falls for lack of members. See *Achna* and *Diphoridas*.

HELIOPETES Haplotype *Papilio arsalte* Linn.
1820, Billberg, Enum. Ins. 81. (*fide* Scudder).

HEMIPTERIS Haplotype *Hemipteris fumida* Mab.
1889, Mabille, Le Nat. (2), xi, 216.

HERONIA — Haplotype *Telegonus labriaris* Butl.
1912, Mabille and Boullet, Ann. Sci. Nat. Zool., (9), xvi, 139.

HESPERIA — Logotype *Papilio comma* Linn.
1793, Fabricius, Ent. Syst. iii, (1), 258. Corresponds to Linnaeus' *Papiliones plebeji*.
1798, Cuvier, Tabl. Elem. 592. Cites only *malvæ* as an example of the genus.
1810, Latreille, Consid. Gen. 440, cites *proteus*, *malvæ* and *steropes* as "types."
1816, Dalman, Vetensk. Akad. Handl. xxxvii, 200. Cites *comma* as type (*fide* Scudder).
1820–21, Swainson, Zool. Ill. (1), i, 28. Cites *comma* as type.
1833, Curtis, Brit. Ent., Lep. ii, 442. Cites *comma* as type.
1870, Butler, Ent. Mo. Mag. vii, 58. Pseudotype *exclamationis*.
1872, Crotch, Cist. Ent. i, 62. Cites *malvæ* as type, giving Cuvier, 1798, as his authority.
1872, Scudder, Syst. Rev. 52. Also cites *malvæ*.
1875, id. Hist. Sk. 187. Follows same course.
1906, Tutt, Brit. Butt. 218. Also cites *malvæ* as type.
1913, Handlirsch, Schroder's Handbuch iii, 94. Proposes the exception of this and a long list of other genera from suppression on the basis of familiar usage.
1922, Barnes and Lindsey, Ann. Ent. Soc. Am. xv, 94. This history is here given in detail, with a discussion of Cuvier's work showing that the citation of *malvæ* cannot be construed as a fixation of type. It is unfortunate that the genus must be shifted, but it is, after all, only the restoration of a previous correct limitation which prevailed for many years. The changes suggested as the outcome of this correction are the substitution of *Hesperiinæ* (misspelled *Hesperiiæ*) for *Pamphilinæ*. The name *Urbaninæ* would replace the present subfamily *Hesperiinæ*. See *Pamphila* and *Urbanus*.

HESPERILLA — Orthotype *Hesperia ornata* Leach.
1868, Hewitson, Desc. Hesp. ii, 37.

HESPEROPSIS — Orthotype *Thanaos alpheus* Edw.
1905, Dyar, Jn. N. Y. Ent. Soc. xiii, 118.

‡HETEROPIA — Logotype *Heteropia imitatrix* Mabille.
1889, Mabille, Le Nat. (2), xi, 68. Preoccupied in sponges, Carter 1886.
1893, Watson, Proc. Zool. Soc. Lond. 22. Cites *imitatrix* as type. See *Codatractus*.

HETEROPTERUS — Haplotype *Papilio morpheus* Pallas.
1806, Dumeril, Zool. Anal. 271. *Nomen nudum*, *fide* Scudder.
1823, id., Consid. 222, pl. 41. Contained *morpheus* only, *fide* Scudder.
1875, Scudder. Hist. Sk. 190.

HIDARI — Orthotype *Hesperia irava* Moore.
1886, Distant, Rhop. Mal. 392.

HYALOTHYRUS — Haplotype *Papilio nitocris* Cram.
1878, Mabille, Ann. Soc. Ent. Belg. xxi, 23.

HYAROTIS — Orthotype *Papilio adrastus* Cram.
1881, Moore, Lep. Cey. i, 174.

‡HYDA — Haplotype *Hyda micacea* Mab.
1889, Mabille, Bull. Soc. Ent. Fr. (6), ix, p. clxxxiii. Preoccupied by *Hyda* Walker, Lep., 1854. See *Ulva*

HYDRÆNOMIA — Orthotype *Eudamus orcinus* Feld.
1870, Butler, Ent. Mo. Mag. vii, 99. Emendation of *Udranomia*, q.v.

HYLEPHILA — Logotype *Papilio phylæus* Dru.
1820, Billberg, Enum. Ins. 81. Included *comma*, *phylæus*, *sylvanus*, and two ms. species, *fide* Scudder.
1875, Scudder, Hist. Sk. 193. Cites *phylæus* as type.
1920, Collins, Trans. Ent. Soc. Lond. 311. In discussing *Hylephila* Rondani, Dipt., 1877, Collins says that Billberg's genera cannot be considered valid,

and refers to Walsingham and Durrant. The notes of these gentlemen fail to establish invalidity of the work in question according to present rules. See *Euthymus*.

HYPOCRYPTOTHRIX Orthotype *Erycides teutas* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 22.

HYPOLEUCIS Logotype *Hypoleucis tripunctata* Mab.
1891, Mabille, C. R. Soc. Ent. Belg. xxxv, p. lxix. *Tripunctata* and *arela*.
1893, Watson, Proc. Zool. Soc. London. 82. Cites tripunctata as type.

IAMBRIX Orthotype *Nisoniades salsala* Moore.
1893, Watson, Proc. Zoo. Soc. Lond. 76, pl. iii, f. 25.

IDMON Orthotype *Baoris unicolor* Dist.
1895, De Niceville, Jn. Bomb. Nat. Hist. Soc. ix, 375.

ILMA Haplotype *Ilma jovina* Swin.
1905, Swinhoe, Ann. and Mag. Nat. Hist. (7), xvi, 613.

INESSA Orthotype *Inessa ilion* De N.
1897, De Niceville, Jn. As. Soc. Beng. lxvi, 570.

ISMA Orthotype *Isma obscura* Dist.
1886, Distant, Rhop. Mal. 369.
1893, Watson, Proc. Zool. Soc. Lond. 83.
1897, Elwes and Edwards, Trans. Zool. Soc. Lond. 204. In this reference it is pointed out that Watson had misidentified another insect as *obscura* Dist., and that his diagnosis therefore does not fit *Isma* Dist., although his type citation is correct. The name *Scobura* is proposed for *Isma* Wats.

ISMENE Haplotype *Ismene œdipodea* Swains.
1820–21, Swainson, Zool. Ill. i, pl. xvi.

ISOTEINON Haplotype *Isoteinon lamprospilus* Feld.
1862, Felder, Wien. Ent. Monatschr. vi, 30.

ITON Orthotype *Hesperia semamora* Moore.
1895, De Niceville, Jn. Bomb. Nat. Hist. Soc. ix. 399.

ITYS Orthotype *Itys iadera* De N.
1895, De Niceville, Jn. Bomb. Nat. Hist. Soc. ix, 377. (June 20) Preoccupied by *Itys* Cambridge, Arach., Jan. 1894. See *Kineta*.

JEMADIA Orthotype *Pyrrhopyga hospita* Butl.
1893, Watson. Proc. Zool. Soc. Lond. 14.

JERA Diatype *Dichelura tricuspidata* Mab.
New name for ‡*Dichelura* Mab.

KATREUS Orthotype *Astictopterus johnstonii* Butl.
1893, Watson, Proc. Zool. Soc. Lond. 115.

KEDESTES Orthotype *Hesperia lepenula* Wallgr.
1893, Watson, Proc. Zool. Soc. Lond. 96.

KERANA Orthotype *Astictopterus armatus* Druce.
1886, Distant, Rhop. Mal. 392.

KINETA Diatype *Itys iadera* De N.
New name for ‡*Itys* De N.

KORUTHAIALOS Orthotype *Koruthaialos hector* Wats.
1893, Watson, Proc. Zool. Soc. Lond. 76, pl. ii, f. 8.

LEPTALINA Logotype *Steropes unicolor* Brem. & Gray.
1904, Mabille, Gen. Ins. xvii, 110. *Unicolor* Brem. & Gray and *lepelletieri*, *tsita* and *inornatus* of Trimen. The first may be taken as type.

LEREMA Orthotype *Papilio accius* A. & S.
1872, Scudder, Syst. Rev. 61.

LERODEA Orthotype *Hesperia eufala* Edw.
1872, Scudder, Syst. Rev. 59.

LEUCOCHITONEA — Haplotype *Leucochitonea levubu* Wallgr.
1857, Wallengren, Rhop. Caffr. 52. (*fide* Scudder).

LEUCOSCIRTES — Orthotype *Syrichtus ericetorum* Bdv.
1872, Scudder, Syst. Rev. 52.

LIGNYOSTOLA — Haplotype *Lignyostola pemphigargyra* Mab.
1888, Mabille, Le Nat. (2), x, 221. Type a synonym of *lacydus* Druce, *fide* Godman and Salvin.

LIMOCHORES — Orthotype *Hesperia manataaqua* Scud.
1872, Scudder, Syst. Rev. 59.

‡LINTNERIA — Haplotype *Hesperia zampa* Edw.[1] (*pulverulenta*).
1877, Edwards, Trans. Am. Ent. Soc. vi, 57, 67. On p. 67 Edwards quotes Butler to the effect that *zampa* belongs to a group of species of which he regards *daunus* Cram. as type. In response to Butler's request, Edwards names this group *Lintneria*. It does not seem logical to regard Butler's opinion as a valid type fixation, and in the body of Edwards paper *zampa* is the sole species. It is a synonym of *pulverulenta*. Preoccupied by *Lintneria* Butl., Heterocera, published one month earlier. See *Systasea* and *Systaspes*.

LOBOCLA — Orthotype *Plesioneura liliana* Atk.
1884, Moore, Jn. As. Soc. Beng. liii, 51.

LOPHOIDES — Orthotype *Isoteinon iapis* De N.
1893, Watson, Proc. Zool. Soc. Lond. 84.

LOTONGUS — Orthotype *Eudamus calathus* Hew.
1886, Distant, Rhop. Mal. 369.

LOXOLEXIS — Haplotype *Loxolexis percnoptera* Karsch.
1895, Karsch, Ent. Nachr. xxi, 320 (32).

LYCAS — Logotype *Hesperia argentea* Hew.
1901, Godman, Biol. Cent. Am., Rhop. ii, 618. *Argentea, ceraca.*

LYCHNUCHOIDES — Orthotype *Hesperia saptine* G. & S.
1901, Godman, Biol. Cent. Am., Rhop. ii, 612.

LYCHNUCHUS — Haplotype *Lychnuchus olenus* Hbn.
1825, Hübner, Zutrage, iii, 24.

LYROPTERA
1881, Plötz, Stett. ent. Zeit. xlii, 500. Cites *Lyroptera* Hopff.[2] as one of the many genera united in *Eudamus*. I can find no trace of the name eleswhere and must conclude that it is a *nomen nudum* to be credited to Plötz (Hopff. ms.).

MACHACHUS — Orthotype *Thanaos jhora* De N.
1912, Swinhoe, Lep. Ind. x, 194.

MAHOTIS — Orthotype *Tamyris nurscia* Swains.
1893, Watson, Proc. Zool. Soc. Lond. 13.

MALAZA — Logotype *Cyclopides catocalinus* Mab.
1904, Mabille, Gen. Ins. xvii, 95. *Catocalinus* and *carmides* Hew.

MANARINA — Logotype *Trapezites fastuosus* Mab.
1904, Mabille, Gen. Ins. xvii, 95. *Fastuosus* and *empyreus* Mab.

MARELA — Logotype *Eudamus tamyroides* Feld.
1903, Mabille, Gen. Ins. xvii, 41. *Tamyroides* and *tamyris* Mab.

MASICES — Logotype *Achlyodes anticus* Pl.
1895, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 408. *Anticus* and *sobrinus* G. & S.

MASTOR — Orthotype *Mastor anubis* Godman.
1900, Godman, Biol. Cent. Am., Rhop. ii, 567.

MATAPA — Orthotype *Hesperia aria* Moore.
1881, Moore, Lep. Cey. i, 163.

MATAPOIDES Orthotype *Matapoides smaragdinus* Druce.
1913, Druce, Ann. & Mag. Nat. Hist. ix, 502.

MEGALEAS Haplotype *Hesperia syrna* Godman.
1901, Godman, Biol. Cent. Am., Rhop. ii, 617.

MEGATHYMUS Orthotype *Eudamus yuccæ* Bdv.
1872, Scudder, Syst. Rev. 62. The type is cited as "*Eudryas yuccæ* Boisd.," apparently a *lapsus calami*.

MEGISTIAS Orthotype *Hesperia tripunctata* Latr.
1900, Godman, Biol. Cent. Am., Rhop. ii, 571.

MELANTHES Logotype *Nisoniades brunnea* H.-S.
1904, Mabille, Gen. Ins. xvii, 80. *Brunnea* and *jamaicensis* Mosch.
1905, Sharp, Zool. Rec. xli, 252. Says "for *brunnea*."
1921, Lindsey, Hesp. N. A. 48. Cites *brunnea* as type.

MESODINA Orthotype *Hesperilla halyzia* Hew.
1901, Meyrick, Ent. Mo. Mag. (2), xii, 168.

METARDARIS Haplotype *Pyrrhopyga cosinga* Hew.
1903, Mabille, Gen. Ins. xvii, ii.

METHION Haplotype *Methion melas* Godman.
1900, Godman, Biol. Cent. Am., Rhop. ii, 563.

METHIONOPSIS Orthotype *Methionopsis modestus* Godman.
1901, Godman, Biol. Cent. Am., Rhop. ii, 598.

METISCUS Haplotype *Metiscus atheas* Godman.
1900, Godman, Biol. Cent. Am., Rhop. ii, 562.

METROCLES Haplotype *Metrocles leucogaster* Godman.
1900, Godman, Biol. Cent. Am. Rhop. ii, 558.

METRON Haplotype *Pamphila chrysogastra* Butl.
1900, Godman, Biol. Cent. Am., Rhop. ii, 557.

MICROCERIS Orthotype *Pyrrhopyga variicolor* Men.
1893, Watson, Proc. Zool. Soc. Lond. 15.

MILANION Orthotype *Papilio hemes* Cram.
1895, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 403.

MILENA
1913, Evans, Jn. Bomb. Nat. Hist. Soc. xxi, 559. The name is used thus, "*Parnara* (*Milena*)." Since I have failed to find any other reference to it, I must conclude for the present that it is a *nomen nudum* to be sunk in *Parnara*.

MILTOMIGES Haplotype *Pamphila cinnamomea* H.-S.
1903, Mabille, Gen. Ins. xvii, 72.

‡MIMAS Orthotype *Ismene miltias* Karsch.
1895, De Niceville, Jn. Bomb. Nat. Hist. Soc. ix, 391. Preoccupied by *Mimas* Hübner, Verz. 142, 1822. See *Mimene* J. and T.

MIMENE Diatype *Ismene miltias* Karsch.
1917, Joicey and Talbot, Ann. and Mag. Nat. Hist. (8), xx, 225. New name for ‡*Mimas* de Niceville.

MIMONIADES Haplotype *Erycides iphinous* Latr.
1823, Hübner, Zutrage ii, 27.

‡MIONECTES Haplotype *Entheus infernalis* Mosch.
1903, Mabille, Gen. Ins. xvii, 41. Preoccupied by *Mionectes* Cab., Aves.
This genus is listed in Scudder's Nomenclator without a date; its mere inclusion shows that it was earlier than Mabille's genus. See *Onzis*.

MNASALCAS Haplotype *Pamphila uniformis* Butler
1900, Godman, Biol. Cent. Am., Rhop. ii, 567.

MNASEAS Orthotype *Thymelicus bicolor* Mab.
1901, Godman, Biol. Cent. Am., Rhop. ii, 597.

MNASICLES Orthotype *Mnasicles geta* Godman.
1901, Godman, Biol. Cent. Am., Rhop. ii, 602.

MNASILUS Haplotype *Mnasilus penicillatus* Godman.
1900, Godman, Biol. Cent. Am., Rhop. ii, 569.

MNASINOUS Haplotype *Mnasinous patage* Godman.
1900, Godman, Biol. Cent. Am., Rhop. ii, 561.

MNASITHEUS Orthotype *Mnasitheus cephis* Godman.
1900, Godman, Biol. Cent. Am., Rhop. ii, 565.

MNESTHEUS Orthotype *Phlebodes iltona* Butl.
1901, Godman, Biol. Cent. Am., Rhop. ii, 606.

MOERIS Orthotype *Talides striga* Hbn.
1900, Godman, Biol. Cent. Am., Rhop. ii, 556.

MOLO Haplotype *Hesperia heræa* Hew.
1900, Godman, Biol. Cent. Am., Rhop. ii, 579.

MORYS Haplotype *Apaustus valerius* Mösch.
1900, Godman, Biol. Cent. Am., Rhop. ii, 541.

MOTASINGHA Orthotype *Hesperilla dirphia* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 73.

MUCIA Haplotype *Mucia thyia* Godman.
1900, Godman, Biol. Cent. Am., Rhop. ii, 540.

MURGARIA Orthotype *Telegonus albociliatus* Mab.
1893, Watson, Proc. Zool. Soc. Lond. 37.

MUSCHAMPIA Orthotype *Papilio proto* Esp.
1906, Tutt, Brit. Butt. i, 218. See *Syrichtus*.

MYCTERIS Haplotype *Mycteris caerula* Mab.
1877, Mabille, Pet. Nouv. ii, 114. Type species spelled as above.

MYLON Orthotype *Leucochitonea lassia* Hew.
1894, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 384.

MYSCELUS Logotype *Papilio nobilis* Cram.
1820, Hübner, Verz. bek. Schmett., 110. *Nobilis, sebaldus, erythus*.
1870, Butler, Ent. Mo. Mag. vii, 92. Cites *nobilis* as type.

MYSORIA Orthotype *Papilio acastus* Cram.
1893, Watson, Proc. Zool. Soc. Lond. 12.

NARGA Logotype *Narga chiriquensis* Mab.
1891, Mabille, C. R. Soc. Ent. Belg. xxxv, p. lxx. *Chiriquensis, vidius* and *scopas*, all of Mabille.
1893, Watson, Proc. Zool. Soc. Lond. Cites *chiriquensis* as type.

NASCUS Orthotype *Papilio phocus* Cram.
1893, Watson, Proc. Zool. Soc. Lond. 28.

NENNIUS Diatype *Polygonus lividus* Hbn. (*amyntas*).
1902, Kirby, Wytsman's Hübner, 105. New name for *Polygonus* Hbn. and ‡*Acolastus* Scud., q. v.

NEOHESPERILLA Orthotype *Hesperilla crocea* Misk.
1914, Waterhouse and Lyell, Butt. Aust. 193.

NEONOMA Diatype *Conognathus platon*. Feld.
1893, Watson, Proc. Zool. Soc. Lond. 44. New name for *Conognathus* Feld. q. v.

NERULA Logotype *Nerula nautes* Mab.
1888, Mabille, Le Nat. (2), x, 255. *Nautes, abbreviata* and *pelia*, all new.
1893, Watson, Proc. Zool. Soc. Lond. 130. Cites *nautes* as type.

NETROBALANE Haplotype *Caprona canopis* Trim.
1903, Mabille, Gen. Ins. xvii, 76.

NETROCORYNE Haplotype *Netrocoryne repanda* Feld.
1867, Felder, Reise der Novara, Zool. ii, Lep. Heft. 3, p. 507.

NICONIADES Haplotype *Niconiades xanthaphes* Hbn.
1816-21, Hübner, Exot. Schmett, ii, pl. 147.

NISONIADES Logotype *Papilio bromius* Stoll.
1816, Hübner, Verz. bek. Schmett. 108. *Bromius* and others.
1875, Scudder, Hist. Sk. 228. Cites *bromius* as type.

NOSPHISTIA Haplotype *Ismene perplexa* Mab.
1908, Mabille and Boullet, Ann. Sci. Nat., Zool. (9), vii, 173, 197.

NOTOCRYPTA Orthotype *Plesioneura curvifascia* Feld.
1889, De Niceville, Jn. Bomb. Nat. Hist. Soc. 188.

NYCTUS Haplotype *Nyctus crinitis* Mab.
1891, Mabille, C. R. Soc. Ent. Belg. xxxv, p. cxiv.

OARISMA Orthotype *Hesperia powesheik* Parker.
1872, Scudder, Syst. Rev. 54.

OCHLODES Orthotype *Hesperia nemorum* Bdv.
1872, Scudder, Syst. Rev. 57.

OCHUS Orthotype *Cyclopides subvittatus* Moore.
1894, De Niceville, Jn. As. Soc. Beng. lxiii, 51.

OCYBA Diatype *Caecina calathana* Hew.
New name for ‡*Caecina* Hew., q. v.

OCYBADISTES Orthotype *Ocybadistes walkeri* Heron.
1894, Heron, Ann. Mag. Nat. Hist. (6), xiv, 105.

OCYTES Orthotype *Hesperia metea* Scud.
1872, Scudder, Syst. Rev. 55.

ODINA Haplotype *Odina chrysomeloena* Mab.
1891, Mabille, C. R. Soc. Ent. Belg. cxii.

ODONTOPTILUM Orthotype *Achloydes sura* Moore.
1890, De Niceville, Jn. Bomb. Nat. Hist. Soc. 217.

OECHYDRUS Orthotype *Eudamus chersis* H.-S.
1893, Watson, Proc. Zool. Soc. Lond. 35.

OEDALONEURA Haplotype *Pamphila heterochrus* Mab.
1904, Mabille, Gen. Ins. xvii, 101.

OENIDES Haplotype *Hesperia vulpina* Feld.
1904, Mabille, Gen. Ins. xvii, 178.

OEONUS Haplotype *Oeonus pyste* Godman.
1900, Godman, Biol. Cent. Am., Rhop. ii, 539. *Hesperia degener* Pl., said probably to belong in the genus also.

OERANE Logotype *Notocrypta neaera* De N.
1897, Elwes and Edwards, Trans. Zool. Soc. Lond. xiv, 242, *microthyrus* Mab. and *neaera* De Nic.

OILEIDES Logotype *Oileides zephodes* Hbn.
1820–26, Hübner, Exot. Schmett. ii, pl. 364 and 365. *Zephodes* and *vulpinus* appeared separately on the two plates; whether at different dates is not known.
1875, Scudder, Hist. Sk. 232. Cites *zephodes* as type.

OLIGORIA Orthotype *Hesperia maculata* Edw.
1872, Scudder, Syst. Rev. 61.

ONENSES Haplotype *Leucochitonea hyalophora* Feld.
1895, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 414.

ONOPHAS Haplotype *Pamphila columbaria* H.-S.
1900, Godman, Biol. Cent. Am., Rhop. ii, 538.

ONRYZA Orthotype *Parnara ? meiktila* De N.
1893, Watson, Proc. Zool. Soc. Lond. 112, pl. ii, f. 5.

ONZIS Diatype *Entheus infernalis* Mösch.
New name for ‡*Mionectes* Mab., q. v.

OREISPLANUS Orthotype *Hesperilla munionga* Olliff.
1914, Waterhouse and Lyell, Butt. Aust. 183.

ORNEATES — Orthotype *Eudamus aegiochus* Hew.
1894, Godman, Biol. Cent. Am., Rhop. ii, 345.

ORPHE — Orthotype *Hesperia gerasa* Hew.
1901, Godman, Biol. Cent. Am., Rhop. ii, 619.

ORSES — Orthotype *Hesperia cynisca* Hew.
1901, Godman, Biol. Cent. Am., Rhop. ii, 621.

ORTHOLEXIS — Haplotype *Ortholexis melichroptera* Karsch.
1895, Karsch, Ent. Nachr. xxi, 319.

ORTHOPHOETUS — Diatype *Eudamus phanaeus* Hew.
1895, Watson, Jn. As. Soc. Beng. ix, 419. New name for ‡*Pteroxys* Wats.

OSMODES — Orthotype *Hesperia laronia* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 78.

OSPHANTES — Orthotype *Plastingia ogowena* Mab.
1896, Holland, Proc. Zool. Soc. Lond. 46.

OULEUS — Orthotype *Achlyodes fridericus* Hbn.
To replace *Achlyodes* Scudder, not Hübner.

OXYNETRA — Haplotype *Oxynetra semihyalina* Feld.
1862, Felder, Wien. Ent. Mon. vi, 179.

OXYNTHES — Haplotype *Goniloba corusca* H.-S.
1900, Godman, Biol. Cent. Am., Rhop. ii, 527.

OXYPALPUS — Orthotype *Pamphila ignita* Mab.
1893, Watson, Proc. Zool. Soc. Lond. 78.

OXYTOXIA — Logotype *Telesto doubledayi* Feld.
1904, Mabille, Gen. Ins. xvii, 93. *Doubledayi, ismene* Newm., *compacta* Butl., *argenteoornatus* Hew. and one doubtful species.
1905, Sharp. Zool. Rec. xli. 252 Cites with *doubledayi* only.

PACHES — Orthotype *Phareas loxus* Westw.
1895, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 398.

PACHYNEURIA — Haplotype *Pachyneuria obscura* Mab.
1888, Mabille, Le Nat. (2), x, 275.

PACHYRHOPALA — Haplotype *Papilio phidias* Linn.
1858, Wallengren, K. Vet. Akad. Fohr. xv, 2. (*fide* Scudder).

PADRAONA — Orthotype *Pamphila maesa* Moore. (*dara*).
1881, Moore, Lep. Cey. 170.

PADUKA — Orthotype *Paduka glandulosa* Dist.
1886, Distant, Rhop. Mal. 369.

PAMPHILA — Logotype *Papilio comma* Linn.
1807, Fabricius, Ill. Mag. vi, 287. *Palaemon, comma,* and others.
1840, Westwood, Gen. Syn. Cites *comma* as type.
1870, Butler, Ent. Mo. Mag. vii, 93. Cites *comma* as type.
1872, Scudder, Syst. Rev. 56. Cites *comma* as type.
1875, id., Hist. Sk. 236. Discards *comma* for insufficient reasons, and cites *palaemon* as type.
1916, Barnes and McDunnough, Contr. iii, 125. Point out that *comma* is the type. Since 1875 the genus has been used in both ways.
See *Hesperia.*

PAMPHILIDA — Orthotype *Papilio palaemon* Pallas.
New genus to replace *Carterocephalus* Auct. and *Pamphila* Auct., q. v.

PAMPHILITES — Haplotype *Pamphilites abdita* Scud.
1875, Scudder, Fossil Butterflies, p. 66. A genus of fossils.

PANSYDIA — Orthotype *Hesperia mesogramma* Poey.
1872, Scudder, Syst. Rev. 60.

PAPIAS — Orthotype *Hesperia infuscata* Pl.
1900, Godman, Biol. Cent. Am., Rhop. ii, 559.

PARACARYSTUS — Orthotype *Cobalus hypargyra* H.-S.
1900, Godman, Biol. Cent. Am., Rhop. ii, 587.

PARADOPAEA — Logotype *Hesperia garita* Reak.
1900, Godman, Biol. Cent. Am., Rhop. ii, 469; footnote and plate 92. Discarded for *Oarisma*, before the writing of the text, but it is a validly published name.

PARADROS — Orthotype *Eudamus phoenice* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 39.

PARAIDES — Orthotype *Hesperia ocrinus* Pl.
1900, Godman, Biol. Cent. Am., Rhop. ii, 515.

PARAMIMUS — Logotype *Paramimus scurra* Hbn.
1820, Hübner, Verz. bek. Schmett. 115. *Scurra*, *talaus*, and *eumelus*.
1870, Butler, Ent. Mo. Mag. vii, 97. Cites *scurra* as type.

PARATA — Orthotype *Papilio chromus* Cram.
1881, Moore, Lep. Cey. i, 160.

‡PARATRYTONE — Orthotype *Pamphila howardi* Skin.
1905, Dyar, Jn., N. Y. Ent. Soc. xiii, 136. Preoccupied in the same family by *Paratrytone* G. S., 1900.

PARATRYTONE — Orthotype *Paratrytone rhexenor* Godman.
1900, Godman, Biol. Cent. Am., Rhop. ii, 487.

PARDALEODES — Orthotype *Papilio edipus* Cram.
1870, Butler, Ent. Mo. Mag. vii, 96.

PARNARA — Orthotype *Eudamus guttatus* Brem.
1881, Moore, Lep. Cey. i, 166.
1903, Mabille, Gen. Ins. xvii, 137. Pseudotype *moolata* Mre.

PAROSMODES — Orthotype *Pamphila morantii* Trim.
1896, Holland, Proc. Zool. Soc. Lond. 45.

PARPHORUS — Orthotype *Phlebodes storax* Mab.
1900, Godman, Biol. Cent. Am., Rhop. ii, 576.

PATLASINGHA — Orthotype *Hesperia phigalia* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 74.

PEDESTES — Orthotype *Isoteinon masuriensis* Mre.
1893, Watson, Proc. Zool. Soc. Lond. 81.

PELEUS — Orthotype *Papilio peleus* Linn.
1832–33, Swainson, Zool. Ill. ii, 75. See *Entheus* and *Phareas*.

PELION — Haplotype *Papilio linea* D. & S. (*thaumas*).
1858, Kirby, List Brit. Rhop. (*fide* Scudder).
1875, Scudder, Hist. Sk. 243. Cites *thaumas* (*linea*) as type, saying that it was the sole species, and regards the genus as a homonym of *Pelia*. It will fall before *Adopaea* Billb. with the same type.

PELLICIA — Logotype *Pellicia dimidiata* H. S.
1870, Herrich-Schaffer, Corr. Blatt. Regensb. 159.
1875, Scudder, Hist. Sk. 243. Cites *dimidiatus* as type.
1893, Watson, Proc. Zool. Soc. Lond. 44. Cites *dimidiatus*.

PELOPIDAS — Haplotype *Pelopidas midea* Wlk.
1870, Walker, Ent. v, 56. In this reference the genus is not mentioned as new, and it is not included at all in Scudder's Historical Sketch.
1896, Holland, Proc. Zool. Soc. Lond. 27. Places *midea* doubtfully in *Carcharodus*, and mentions *Pelopidas* only through citation of Walker's reference. The only other reference known to me is the Zool. Rec. for 1870.

PERICHARES — Orthotype *Papilio corydon* Fab.
1872, Scudder, Syst. Rev. 60.

PERIMELES — Haplotype *Hesperia remus* Fab.
1900, Godman, Biol. Cent. Am., Rhop. ii, 542.

PHANES — Diatype *Hesperia justinianus* Latr.
1901, Godman, Biol. Cent. Am., Rhop. ii, 741. New name for ‡*Phanis*.

‡PHANIS — Orthotype *Hesperia justinianus* Latr.
1900, Godman, Biol. Cent. Am., Rhop. ii, 548. Preoccupied in *Coleoptera* by Fairmaire, 1893.

PHANUS — Haplotype *Papilio vitreus* Cram.
1820, Hübner, Verz. bek. Schmett. 114.

PHAREAS — Logotype *Papilio peleus* Linn.
1852, Westwood, Gen. Diurn. Lep. 515. Twelve species, including *gentius* and *peleus*.
1875, Scudder, Hist. Sk. 247. Says that these two species were specified as typical and adds that they are congeneric and that the genus therefore falls before *Entheus*.
1893, Watson, Proc. Zool. Soc. Lond. 49. Cites *gentius* and *peleus* as types. *Peleus* may be taken as type. See *Peleus* and *Entheus*.

PHEMIADES — Logotype *Papilio phineus* Cram.
1820, Hübner, Verz. bek. Schmett. 112. Five species.
1875, Scudder, Hist. Sk. 147. Cites *phineus* as type.

PHERAEUS — Haplotype *Carystus epidius* Mab.
1900, Godman, Biol. Cent. Am., Rhop. ii, 578.

PHILOODUS — Logotype *Papilio nostrodamus* Fab.
1849, Rambur, Faun. Ent. Andal. ii, 308; (*fide* Scudder).
1875, Scudder, Hist. Sk. 248. Regards *lefebvrei* as a synonym of *nostrodamus* and therefore cites the latter as sole species and type.
1893, Watson, Proc. Zool. Soc. Lond. 104. Cites *nostrodamus* as type.

PHLEBODES — Logotype *Papilio pertinax* Cram.
1820, Hübner, Verz. bek. Schmett. 107. *Pertinax* and *saturnus*.
1870, Butler, Ent. Mo. Mag. vii, 93. Cites *pertinax* as type.
1875, Scudder, Hist. Sk., 248. Follows Butler.

PHOCIDES — Logotype *Phocides cruentus* Hbn. (*palemon* Cr.)
1820, Hübner, Verz. bek. Schmett, 103. *Cruentus, alardus, lisiades*.
1875, Scudder, Hist. Sk. 248. Cites *palemon* (*cruentus*) as type.

PHOEDINUS — Logotype *Eudamus caicus* H.-S.
1894, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 335. *Caicus* and *aventinus*.
1921, Lindsey, Hesp. N. A. 35. Cites *caicus* as type.
See *Anaperus* M. and B.

PHOENICOPS — Orthotype *Netrocoryne beata* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 30.

PHOLISORA — Orthotype *Papilio catullus* Fab.
1872, Scudder, Syst. Rev. 51.

PHYCANASSA — Orthotype *Hesperia viator* Edw.
1872, Scudder, Syst. Rev. 56.

PHYSALEA — Haplotype *Telemiades vulpecula* Pl.
1903, Mabille, Gen. Ins. xvii, 26.

PIRDANA — Orthotype *Hesperia hyela* Hew.
1886, Distant, Rhop. Mal. 369.

PISOLA — Haplotype *Pisola zennara* Mre.
1865, Moore, Proc. Zool. Soc. Lond. 785.

PITHAURIA — Haplotype *Hesperia murdava* Mre.
1878, Moore, Proc. Zool. Soc. Lond. 689.

PITHAURIOPSIS — Haplotype *Pithauriopsis aitchisoni* W. M. & De N.
1886, Wood-Mason and de Niceville, Jn. As. Soc. Beng. iv, 387.

PLAGIOTHYRUS — Haplotype *Cobalus leucomelas* Hbn.
1916, Mabille and Boullet, Ann. Sci. Nat. Zool. (10), ii, 247.

PLASTINGIA — Orthotype *Hesperia flavescens* Feld.
1870, Butler, Ent. Mo. Mag. vii, 95.

PLATYLESCHES — Orthotype *Parnara picanini* Holl.
1896, Holland, Proc. Zool. Soc. Lond. 72.

‡PLESIOCERA — Haplotype *Plesiocera filipalpis* Mab.
1891, Mabille, C. R. Soc. Ent. Belg. xxxv, p. cvi. Later Mabille submerged the genus in *Systasea* Edw., so a new name is apparently unnecessary. Preoccupied by *Plesiocera* Macq., Dipt. This is listed in the Nomenclator without a date.

‡PLESIONEURA — Haplotype *Plesioneura curvifascia* Feld.
1862, Felder, Wien. Ent. Mon. vi, 29. Preoccupied by *Plesioneura* Macq., Dipt., 1855, *fide* Nomenclator.
1870, Butler, Ent. Mo. Mag. vii, 95. Cites *curvifascia* as type.
See *Notocrypta*.

‡PLESTIA — Haplotype *Plestia staudingeri* Mab.
1888, Mabille, Le Nat. (2), x, 146. Preoccupied by *Plestia* Stal, Hemip., 1871.
See *Zestusa*.

PLOETZIA — Haplotype *Hesperia amygdalis* Mab.
1886, Saalmüller, Lep. Mad., i, 115. See *Systole*.

POANES — Orthotype *Hesperia massasoit* Scud.
1872, Scudder, Syst. Rev. 55.

POANOPSIS — Orthotype *Pamphila puxillius* Mab.
1900, Godman, Biol. Cent. Am., Rhop. ii, 486.

POLA — Orthotype *Ismene ataphus* Wats.
1913, Swinhoe, Lep. Ind. ix, 266.

POLITES — Orthotype *Hesperia peckius* Kirby.
1872, Scudder, Syst. Rev. 57, 1872.

POLYGONUS — Haplotype *Polygonus lividus* Hbn. (*amyntas*).
1822–26, Hübner, Exot. Schmett. ii, 144.
1875, Scudder, Hist. Sk. 253. Says that the name is a homonym of *Polygona*, but the Int. Rules allow it to stand. See ‡*Acolastus* and *Nennius*.

POLYTHRIX — Orthotype *Eudamus metallescens* Mab.
1893, Watson, Proc. Zool. Soc. Lond. 19.

POLYTREMIS — Orthotype *Gegenes contigua* Mab.
1903, Mabille, Gen. Ins. xvii, 136.

PORPHYROGENES — Orthotype *Telegonus omphale* Butl.
1893, Watson, Proc. Zool. Soc. Lond. 35.

‡POTAMANAX — Orthotype *Leucochitonea flavofasciata* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 55. Preoccupied by *Potamanax* Pilsbry, Mollusca, 1892. See *Potamanaxas*.

POTAMANAXAS — Diatype *Leucochitonea flavofasciata* Hew.
New name for †*Potamanax*, q. v.

POTANTHUS — Orthotype *Hesperia omaha* Edw.
1872, Scudder, Syst. Rev. 54.

‡POWELLIA — Orthotype *Papilio sao* Hbn.
1906, Tutt, Brit. Butt. i, 218. Preoccupied by *Powellia* Mask., Hemip. 1879.

‡PRAXIS — Haplotype *Praxis quadrata* Mab.
1889, Mabille, Le Nat. (2), xi, 25. Preoccupied by *Praxis* Gn., Lep. 1852, and *Praxis* Adams, Moll., 1858. See *Xispia*.

PRENES — Orthotype *Hesperia panoquin* Scud.
1872, Scudder, Syst. Rev. 60.

PROBLEMA — Orthotype *Pamphila byssus* Edw.
1924, Skinner & Williams, Trans. Am. Ent. Soc. 1, 62,

PROCAMPTA — Orthotype *Procampta rara* Holl.
1892, Holland, Ann. and Mag. Nat. Hist. (6), x, 294.

PROSOPALPUS — Orthotype *Cobalus duplex* Mab.
1896, Holland, Proc. Zool. Soc. Lond. 53.

PROTEIDES — Logotype *Papilio mercurius* Cram. (*idas*).
1820, Hübner, Verz. bek Schmett. 104. *Mercurius, zestos*, etc.
1870, Butler, Ent. Mo. Mag. vii, 93. Cites *mercurius* as type. See *Dicranaspis*.

‡PROTOGENES — Logotype *Eudamus extrusus* Feld.
1912, Mabille and Boullet, Ann. Sci. Nat. Zool. (9), xvi, 92. *Extrusus* Feld, and *affinis* M. and B. Preoccupied by *Protogenes* Hack., Prot., 1865 and *Protogenes* Saalm., Ins., 1884. The first species may be taken as type. See *Vlasta*.

PSEUDOCOPAEODES Orthotype *Copaeodes eunus* Edw.
1923, Skinner and Williams, Trans. Am. Ent. Soc. xlix, 137.

PSEUDOSARBIA Haplotype *Pseudosarbia phoenicola* Berg.
1897, Berg. An. Mus. Buenos Aires, v, 256.

PSOLOS Orthotype *Tagiades pulligo* Mab.
1893, Watson, Proc. Zool. Soc. Lond. 87. Listed as a synonym of *Sancus:* "?*Psolos*, Mabille Ms."

PSORALIS Haplotype *Psoralis sabaeus* Mab.
1904, Mabille, Gen. Ins. xvii, 133.

PTEROTEINON Diatype *Hesperia laufella* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 124. New name for ‡*Tanyptera* Mab.

‡PTEROXYS Orthotype *Eudamus phanaeus* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 29. Preoccupied, *fide* Elwes and Edwards. I have no reference to the earlier use. See *Orthophoetus*.

PTERYGOSPIDEA Logotype *Papilio ophion* Stoll (*flesus*).
1857, Wallengren, Rhop. Caffr. 53. *Ophion, motozi, mokeesi* and *nottoana*.
1875, Scudder, Hist. Sk. 260. Cites *flesus* (*ophion*) as type. Reasoning faulty, but the fixation will apparently stand.
1893, Watson, Proc. Zool. Soc. Lond. 53. Under *Tagiades*, cites *flesus* as type.

PUDICITIA Orthotype *Parnara pholus* De N.
1895, De Niceville, Jn. Bomb. Nat. Hist. Soc. ix, 379.

PYRDALUS Haplotype *Papilio corbulo* Cram.
1903, Mabille, Gen. Ins. xvii, 60.

PYRGUS Logotype *Papilio syrichtus* Fab.
1820, Hübner, Verz. bek. Schmett. 109. *Syrichtus, oilus*, etc.
1870, Butler, Ent. Mo. Mag. vii, 94. Cites *syrichtus* as type.

PYRRHOCALLES Haplotype *Pamphila antiqua* H. S.
1904, Mabille, Gen. Ins. xvii, 143.

PYRRHOCHALCIA Logotype *Papilio iphis* Dru.
1904, Mabille, Gen. Ins. xvii, 89.

PYRRHOPYGE Logotype *Papilio bixæ* Cram.
1820, Hübner, Verz. bek. Schmett. 103. *Bixæ, hyperici, phidias* and others.
1872, Scudder, Syst. Rev. 46. Cites bixæ as type of "*Pyrrhopyga*."
1875, id., Hist. Sk. 261-262. Pseudotype *hyperici*.
1893, Watson, Proc. Zool. Soc. Lond. ii, Pseudotype *hyperici*.
Scudder's first designation was valid. *Bixæ* and *hyperici* are congeneric however, so no change results.

PYRRHOPYGOPSIS Orthotype *Pyrrhopyge socrates* Men.
1901, Godman, Biol. Cent. Am., Rhop. ii, 634.

PYRRHOSIDIA Orthotype *Hesperia mystic* Edw.
1874, Scudder, Mem. Bost. Soc. Nat. Hist. ii, 346, footnote.

PYTHONIDES Logotype *Papilio jovianus* Cram.
1820, Hübner, Verz. bek. Schmett. 110. *Jovianus, cerberus* (*cerialis*), and *herennius*.
1870, Butler, Ent. Mo. Mag. vii, 97. Cites *jovianus* as type.
1875, Scudder, Hist. Sk. 262. Because of a supposed restriction, casts out Butler's fixation and cites *cerialis* as type. Butler's citation was, however, valid according to the Int. Rules and will stand. The genus has been used with *cerialis* as type, which led G. and S. to describe *Ate* for *jovianus* and allies. *Ate* and *Pythonides* are therefore identical, and *Pythonides* Auct. must be replaced. See *Quadrus*.

QUADRUS Orthotype *Papilio cerialis* Cram.
New genus to take the place of *Pythonides* Auct.

QUEDARA Orthotype *Quedara comoplea* Swin.
1919, Swinhoe, Ann. and Mag. Nat. Hist. (ix), iii, 316.

REVERDINUS Type *Carcharodus altheæ* Hbn.
1919, Ragusa, Naturalista Sicil. xxiii, 172. I have this reference from the Zool. Record only, and have been unable to determine the circumstances of the type fixation.

RHABDOIDES Haplotype *Eudamus cellus* Bdv. and Lec.
1889, Scudder, Butt. E. U. S. iii, p. 1854.

RHABDOMANTIS Orthotype *Hesperia galatia* Hew.
1896, Holland, Proc. Zool. Soc. Lond. 44.

RHINTHON Orthotype *Proteides chiriquensis* Mab.
1900, Godman, Biol. Cent. Am., Rhop. ii, 530.

RHOPALOCAMPTA Logotype *Papilio forestan* Cram.
1857, Wallengren, Rhop. Caffr. 4. (*fide* Scudder.)
1875, Scudder, Hist. Sk. 263. States that an action of Wallengren fixed *forestan* as the type. This was not in accordance with present ideas, but Scudder's citation may stand.
1893, Watson. Proc. Zool. Soc. Lond. 129. Also cites *forestan*.

SABERA Orthotype *Hesperia cæsina* Hew.
1908, Swinhoe, Trans. Ent. Soc. Lond. 30.

SANCUS Orthotype *Astictopterus subfasciatus* Moore.
1891, De Niceville, Jn. Bomb. Nat. Hist. Soc. vi, 395.

SAPÆA Orthotype *Leucochitonea bicolor* Trimen.
1879, Plötz, Stett. ent. Zeit. xl, 177, 179.

SAPE Logotype *Sape lucidella* Mab.
1891, Mabille, Bull. Soc. Ent. Belg. xxxv, p. lxvii. *Lucidella* and four other species, all new.
1893, Watson, Proc. Zool. Soc. Lond. 48. Cites *lucidella* as type.

SARANGESA Orthotype *Sarangesa purendra* Mre.
1881, Moore, Lep, Cey. i, 176.

SARBIA Orthotype *Hesperia xanthippe* Latr.
1893, Watson, Proc. Zool. Soc. Lond. 13.

SAREGA Haplotype *Sarega staurus* Mab.
1904, Mabille, Gen. Ins. xvii, 133.

SARMIENTOIA Orthotype *Dyscophus faustinus* Burm.
1897, Berg, Ann. Mus. Buenos Aires, v, 249.

SATARUPA Logotype *Goniloba gopala* Moore.
1865, Moore, Proc. Zool. Soc. Lond. 780. *Gopala, sambara, bhagava.*
1875, Scudder, Hist. Sk. 265. Cites *gopala* as type.

SCANTILLA Haplotype *Scantilla opites* G. & S.
1896, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 437.

SCELOTHRIX Logotype *Papilio carthami* Hbn.
1858, Rambur, Cat, Lep. Andal. i, 63. 13 species. (*fide* Scudder).
1875, Scudder, Hist. Sk. 266. Says that it falls before *Hesperia* without giving a type.
1893, Watson, Proc. Zool. Soc. Lond. 65. Under *Hesperia*, cites *carthami*, the first species included by Rambur, as type.
1916, Barnes and McDunnough, Contr. iii, 121. Pseudotype *malvæ*.

SCOBURA Logotype *Hesperia cephala* Hew.
1897, Elwes and Edwards, Trans. Zool. Soc. Lond. xiv, 204. New genus to replace *Isma* Watson (not Dist.).
No type was specified by Elwes and Edwards, but they claim that Watson's description was based on *cephala* Hew., so that species is the logical selection. Watson later (Jn. Bomb. Nat. Hist. Soc. ix, 411, 1895) noted his own error and referred *cephala* to *Zographetus*.

SEBALDIA Haplotype *Papilio busirus* Cram.
1903, Mabille, Gen. Ins. xvii, 66. See *Achlyodes* and *Eantis*.

SEBASTONYMA Orthotype *Hesperia dolopia* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 81.

SEMALEA Orthotype *Hesperia pulvina* Pl.
1896, Holland, Proc. Zool. Soc. Lond. 64.

SEPA Orthotype *Sepa cronus* De N.
1894, De Niceville, Jn. As. Soc. Beng. lxiii, 49.

SERDIS Haplotype *Serdis flagrans* Mab.
1904, Mabille, Gen. Ins. xvii, 144.

SIGNETA Orthotype *Telesto flammeata* Butl.
1914, Waterhouse and Lyell, Butt. Aust. 198.

SLOPERIA Orthotype *Hesperia poggei* Led.
1906, Tutt, Brit. Butt. i, 218.

SOPHISTA Orthotype *Goniloba aristoteles* Westw.
1879, Plötz, Stett. ent. Zeit. xl, 176.

SOSTRATA Logotype *Leucochitonea scintillans* Mab.
1895, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 397.

SPATHILEPIA Orthotype *Papilio clonius* Cram.
1870, Butler, Ent. Mo. Mag. vii, 57.

SPIALIA Orthotype *Hesperia galba* Fab.
1912, Swinhoe, Lep. Ind. x, 99.

SPILOTHYRUS Logotype *Papilio malvæ* Linn.
1832, Duponchel, Pap. France, Diurn., Suppl. 415. *Malvæ, altheæ, lavateræ.* (*fide* Scudder). I have been unable to check these data otherwise.
1875, Scudder, Hist. Sk. 270. Merely notes that it falls before *Urbanus*.
1893, Watson, Proc. Zool. Soc. Lond. 67. Under *Carcharodus*, cites *alceæ* as type, apparently following Scudder (Hist. Sk.) in regarding Duponchel's *malvæ* as *alceæ*. According to his obvious intention and Scudder's remark, it seems wise to regard *malvæ* Linn. as type, and the name will fall before *Urbanus*. Even though Duponchel did not have the true *malvæ*, the Int. Rules wisely limit our selection of a type to the three names, correctly applied. See *Urbanus*.

SPIONIADES Logotype *Papilio artemides* Cram.
1820, Hübner, Verz. bek. Schmett. 114. *Artemides, almon* and *psecas*.
1875, Scudder, Hist. Sk. 270. Cites *artemides* as type.

§STÆMACTIS
See *Hæmactis*.

STAPHYLUS Orthotype *Helias ascalaphus* Stgr.
1896, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 429.

‡STEROPES Logotype *Papilio jacchus* Fab.
1832, Boisduval, Voy. Astrol. 167. *Picta, ornata* and *jacchus, fide* Scudder.
1875, Scudder, Hist. Sk. 270. Cites no type but says that the genus falls before *Carterocephalus* and *Pamphila*, and notes that it is a homonym.
1893, Watson, Proc. Zool. Soc. Lond. 89. Under *Pamphila*, cites no type.
Preoccupied by *Steropes* Stev., Col., 1806. Apparently no type has been cited for the genus, and the prevailing incorrect use of *Carterocephalus* which was established to take its place, makes it necessary to select one. All of the three included species are Australian. Lower, in his revision of the Australian Hesperiidæ, places the first two in *Hesperilla* and the last in *Trapezites*, and in order to avoid displacing either of these well known and definitely limited names it seems desirable to select *jacchus*. By this course ‡*Steropes* and *Carterocephalus* will fall before *Trapezites* and *Carterocephalus* Auct., which could not stand in its present sense, may be replaced by a new name.
See *Carterocephalus, Pamphila* and *Pamphilida*.

STETHOTRIX Haplotype *Stethotrix heterogyna* Mab.
1889, Mabille, Bull. Soc. Ent. France (6), ix, p. clxxxiv.

STIMULA Diatype *Watsonia swinhœi* E. & E.
1898, De Niceville, Jn. Bomb. Nat. Hist. Soc. xii, 159. (Dec. 10). New name for ‡*Watsonia* E. & E., q. v. See also *Watsoniella*.

STOMYLES Orthotype *Pyrgus textor* Hbn.
1872, Scudder, Syst. Rev. 55.

STYRIODES Orthotype *Styriodes lyco* Schaus.
1913, Schaus, Proc. Zool. Soc. Lond. 361.

SUADA Orthotype *Hesperia swerga* De N.
1895, De Niceville, Jn. Bomb. Nat. Hist. Soc. ix, 370.

SUASTUS Orthotype *Hesperia gremius* Fab.
1881, Moore, Lep. Cey. i, 168.

SYNALE Haplotype *Papilio hylaspes* Cram.
1904, Mabille, Gen. Ins. xvii, 159.

SYNAPTE Haplotype *Carystus salenus* Mab.
1904, Mabille, Gen. Ins. xvii, 133. There is a genus *Synapta*, Eschsch., Ech., 1829, according to the Nomenclator.

SYRICHTUS Logotype *Papilio proto* Esp.
1832–3, Boisduval, Icones, 230.
1875, Scudder, Hist. Sk. 273. Says that the name falls because derived from the name of a species intended to be included.
1893, Watson, Proc. Zool. Soc. Lond. 64. Follows Scudder.
1897, Elwes and Edwards, Rev. Or. Hesp. 153. Uhler *Hesperia*, cites *proto* as type. See *Muschampia*.

SYSTASEA Diatype *Leucochitonea pulverulenta* Feld.
1877, Butler, in Edwards, Can. Ent. ix, 120. New name for ‡*Lintneria* Edw. See *Antigonus*.

§SYSTASPES
1905, Weeks, Ill. Diurn. Lep. i, This name was merely listed in the combination *Systaspes corrosa*. Weeks (in litt.) says that he received the name from Swinhoe and later replaced it by *Nascus!* Schaus regards it as a typographical or clerical error for *Systasea*, and in spite of the mention of *Nascus*, this opinion seems most reasonable because of its association with *corrosa* Mab. There is certainly no reason to believe that it was proposed as new, so it may well stand as Schaus interprets it.

‡SYSTOLE Haplotype *Hesperia amygdalis* Mab.
1887, Mabille, Lep. Mad. ii, pl. li, ff. 6, 6a, 7, 1885, and i, 330. 1886 or 7. See *Acleros* regarding date. If the text should prove to have been published as early as the plates, the type would be an *orthotype*. The name is a homonym of *Systole* Wlk., Hym. 1832. See *Plœtzia*.

TAGIADES Logotype *Papilio japetus* Cram.
1820, Hübner, Verz. bek. Schmett. 108. *Japetus* and *paulinus*.
1870, Butler, Ent. Mo. Mag. vii, 99. Fixes type.

TALIDES Logotype *Talides athenion* Hbn.
1820, Hübner, Verz. bek. Schmett. 106. *Athenion, obscurus* and others.
1870, Butler, Ent. Mo. Mag. vii, 93. Cites *athenion* as type.
1875, Scudder, Hist. Sk. 275. Pseudotype *sergestus*, based on a supposed restriction.

TAMELA Orthotype *Nisoniades diocles* Moore.
1913, Swinhoe, Lep. Ind. x, 207.

TAMYRIS Haplotype *Hesperia zeleucus* Fab.
1820–21, Swainson, Zool. Ill. (2), i, 33. *Laonome* and *nurscia* on plate 61, *zeleucus* on pl. 33.
1875, Scudder, Hist. Sk. 275. Cites the reference to pl. 33, and gives *zeleucus* as sole species and therefore type. This is undoubtedly correct, since Swainson's work appeared in parts, although the bound set consulted in this study afforded no other evidence.

‡TANYPTERA Haplotype *Hesperia laufella* Hew.
1877, Mabille, Bull. Soc. Ent. France p. 260. Preoccupied by *Tanyptera* Latr., Dipt. (no date given in the Nom. Zool.). See *Pteroteinon*.

TAPENA Orthotype *Tapena thwaitesi* Moore.
1881, Moore, Lep. Cey. i, 181.

TARACTROCERA Haplotype *Hesperia mævius* Fab.
1869, Butler, Cat. Lep. Fab. 279.

TARSOCTENUS Orthotype *Pyrrhopyga plutia* Hew.
1893, Watson, Proc. Zool. Soc. Lond. 21.

TECUPA Orthotype *Tecupa curiosa* Swin.
1917, Swinhoe, Ann. and Mag. Nat. Hist. (8), xx, 410.

TEINORHINUS Orthotype *Teinorhinus watsoni* Holl.
1892, Holland (Watson Ms.) Ann. and Mag. Nat. Hist. (6), x, 292. §*Teniorhinus*.
1893, Watson, Proc. Zool. Soc. Lond. 78. Published as new.
1896, Holland, Proc. Zool. Soc. Lond. 40. Notes corrected spelling.

TELEMIADES Logotype *Papilio avitus* Cram.
1820, Hübner, Verz. bek. Schmett. 106. *Avitus*, *epicalus* and *salatis*.
1875, Scudder, Hist. Sk. 277. Fixes type.

TELEGONUS Logotype *Papilio talus* Cram.
1820, Hübner, Verz. bek. Schmett. 104. *Talus*, *phocus*, *morpheus*, *anaphus*, and *midas*.
1870, Butler, Ent. Mo. Mag. vii, 56. Cites *talus* as type.
1875, Scudder, Hist. Sk. 277. Disregards Butler's fixation because *talus* is a *Thymele*—a convenient but impossible action. Pseudotype *anaphus*. *Talus* must be taken as the type, unfortunately, and *Telegonus* will replace *Thymele* Auct., while that genus must be placed elsewhere. The accepted distinction between the genera is the presence in the males of *Thymele* Auct. of a costal fold. Unless secondary sexual characters again come into favor for the separation of genera, it will be unnecessary to propose a new name for *Telegonus* Auct. See *Thymele*.

‡TELESTO Haplotype *Hesperia peron* Latr. (*peroni*).
1832, Boisduval, Voy. Astrol. 164. Preoccupied by Lam., Moll. (date?), Lam., Pol., 1812 and Raf., Crust. 1814. (*fide* Nomenclator).
1870, Butler, Ent. Mo. Mag. vii, 96. Cites *dirpha* as type, erroneously. Replaced by *Hesperilla*, q. v.

TELICOTA Orthotype *Papilio augias* Linn.
1881, Moore, Lep. Cey. i, 169. See *Astycus*.

TELLES Orthotype *Papilio arcalaus* Cram.
1900, Godman, Biol. Cent. Am., Rhop. ii, 518.

§TENIORHINUS
See *Teinorhinus*.

TERIA Haplotype *Teria agavis* Blas. (*hesperiaris* Wlk.).
1870, Blasquez, La Naturaleza i, 282. (*fide* McDunnough).
1912, Barnes and McDunnough, Contr. i, (3), 12 and 17. Regard it as a misspelling of *Terias* Swains. It will, in any case, fall before *Aegiale*.

THANAOS Logotype *Hesperia juvenalis* Fab.
1832–3, Boisduval, Icones 240. *Marloyi*, *tages* and *juvenalis*. *Juvenalis* is not considered at length, but it is very clearly indicated that Boisduval regarded it as a member of his genus.
1870, Butler, Ent. Mo. Mag. vii, 97. Cites *juvenalis* as type.
1875, Scudder, Hist. Sk. 279. Pseudotype *tages*. *Juvenalis* will stand as type; the two species concerned are congeneric. See *Thymele* and *Erynnis*.

THANATITES Haplotype *Vanessa vetula* von Heyd.
1875, Scudder, Fossil Butterflies. A genus of fossils.

THARGELLA Haplotype *Thargella fuliginosa* Godman.
1900, Godman, Biol. Cent. Am., Rhop. ii, 564.

THEAGENES Diatype *Antigonus aegides* H.-S.
1896, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 428. New name for ‡*Eropus* G. and S.

THEMESION Orthotype *Hesperia certima* Hew.
1901, Godman, Biol. Cent. Am., Rhop. ii, 614.

THESPIEUS Orthotype *Hesperia dalmani* Latr.
1900, Godman, Biol. Cent. Am., Rhop. ii, 519.

THOON Orthotype *Proteides modius* Mab.
1900, Godman, Biol. Cent. Am., Rhop. ii, 529.

THORESSA Orthotype *Pamphila masoni* Moore.
1912, Swinhoe, Lep. Ind. x, 284.

THORYBES Orthotype *Papilio bathyllus* A. and S.
1872, Scudder, Syst. Rev. 50.

THRACIDES Logotype *Papilio phidon* Cram.
1820, Hübner, Verz. bek. Schmett. 105. *Phidon* and *salius*.
1875, Scudder, Hist. Sk. 282. Cites *phidon* as type.

THYMELE Logotype *Papilio tages* Linn.
1807, Fabricius, Ill. Mag. vi, 287. Divided into three groups, with *Proteus*, *mercatus*, and *acastus* in the first, *thrax*, *gnetus*, and *bixæ* in the second, and *aracinthus*, *malvæ*, and *tages* in the third.
1840, Westwood, Gen. Syn. 88. Cites *tages* as type.
1872, Scudder, Syst. Rev. 47. Pseudotype *proteus*.
1875, id., Hist. Sk. 283. Pseudotype *mercatus*. Scudder discards Westwood's designation because Oken (Lehrb. i, 758, 1815) included in the genus of those included by Fab., only the first group. This is not, according to the Int. Rules, a valid restriction. *Thymele* Auct., with *mercatus* as type, will give place to *Telegonus* (q. v.) and *Thymele* Fab. will fall with *Thanaos* before *Erynnis*.

THYMELICUS Logotype *Papilio actæon* Rott.
1820, Hübner, Verz. bek. Schmett. 113. *Acteon*, *pustula*, *vibex* and five others.
1870, Butler, Ent. Mo. Mag. vii, 94. Cites *actæon* as type.
1872, Scudder, Syst. Rev. 54. Cites *acteon* also.
1875, id., Hist. Sk. 283. Cites *vibex* as type for reasons which we must now regard as invalid.
1906, Tutt, Brit. Butt. i, 117. Cites *actæon*, saying that it was fixed by Kirby, List Brit. Rhop. 3, 1858. This was not a valid fixation by present rules.
Butler's designation of *actæon* must stand, thus bringing *Thymelicus* again into association with *Adopæa* of the present classification. Both of the names were established in 1820. Which should be used can probably never be decided accurately. I have no copy of the paper which made known the dates of the Verzeichniss. If there is any doubt that the part under consideration appeared in 1820, it may have antedated Billberg's genus. See *Adopæa*.

TIGASIS Haplotype *Tigasis zalates* Godman.
1900, Godman, Biol. Cent. Am., Rhop. ii, 544.

TIMOCHARES Logotype *Leucochitonea trifasciata* Hew.
1896, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 417.
1921, Lindsey, Hesp. N. A. 55. Cites *trifasciata* as type.

TIMOCHREON Haplotype *Helias satyrus* Feld.
1896, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 439.

TIMOCONIA Orthotype *Timoconia thielei* Strand.
1909, Strand, Int. Ent. Zeit. iii, 176.

§TINORHINUS
1904, Mab., Gen. Ins. xvii, 101. *Teniorhinus*.

TIRYNTHIA Haplotype *Goniloba conflua* H.-S.
1900, Godman, Biol. Cent. Am., Rhop. ii, 523.

TISIAS Orthotype *Proteides myna* Mab.
1901, Godman, Biol. Cent. Am., Rhop. ii, 613.

TOTHRIX — Orthotype *Ismene mahintha* Moore.
1912, Swinhoe, Lep. Ind. ix, 233.

TOXIDIA — Haplotype *Toxidia thyrrhus* Mab.
1891, Mabille, C. R. Soc. Ent. Belg. xxxv, p. lxxx.

TRAPEZITES — Haplotype *Trapezites symmomus* Hbn.
1820, Hübner, Verz. bek. Schmett. 112.

TRICOSEMEIA — Orthotype *Tricosemeia olivescens* Holl.
1892, Holland. Ann. and Mag. Nat. Hist. (6), x, 294.

TRIŒDUSA — Haplotype *Triædusa milvius* Mab.
1904, Mabille, Gen. Ins. xvii, 144.

TURESIS — Orthotype *Hesperia lucas* Fab.
1901, Godman, Biol. Cent. Am., Rhop. ii, 616.

TYPHEDANUS — Haplotype *Typhedanus zephus* Butl. (*umber* H.-S.).
1870, Butler, Trans. Ent. Soc. Lond. 497.

UDASPES — Orthotype *Papilio folus* Cram.
1881, Moore, Lep. Cey. i, 177.

UDRANOMIA — Orthotype *Eudamus orcinus* Feld.
1870, Butler, Ent. Mo. Mag. vii, 58–9. See *Hydrænomia*.

ULVA — Diatype *Hyda micacea* Mab.
New name for ‡*Hyda* Mab., q. v.

UNKANA — Orthotype *Unkana batara* Dist. (Mre. Ms.).
1886, Distant, Rhop. Mal. 369.

URBANUS — Haplotype *Papilio malvæ* Linn.
1806, Hübner, Tentamen.
1875, Scudder, Hist. Sk. 287. Cites *alceæ* as type, regarding *malvæ* Hübner as an incorrect identification. According to the Int. Rules *malvæ* Linn. must be the type.
1922, Barnes and Lindsey, Ann. Ent. Soc. Am. xv, 94. Point out that *Urbanus* will replace *Hesperia* Auct., forming the type genus of the subfamily *Urbaninæ*. See *Spilothyrus*.

(URBICOLA
1906, Tutt, Brit. Butt. i, 152 et. seq. Uses this as a genus, attributed to Barbut. Barbut, however, cites "P. P. U."-species just as Linnæus did, so I can find no reason to believe that he established a different usage. In the Systema Naturæ, *Papilio* was named as a genus, whence it would follow that *Plebeius* was a subgenus and *Urbicola* a group too low to be treated as a genus according to present rules.)

VACERRA — Orthotype *Hesperia litana* Hew.
1900, Godman, Biol. Cent. Am., Rhop. ii, 521.

VEHILIUS — Orthotype *Cobalus illudens* Mab.
1900, Godman, Biol. Cent. Am., Rhop. ii, 570.

VETTIUS — Orthotype *Papilio phyllus* Cram.
1901, Godman, Biol. Cent. Am., Rhop. ii, 589.

VINIUS — Logotype *Vinius arignote* Godman.
1900, Godman, Biol. Cent. Am., Rhop. ii, 580. *Arignote* and others.

VLASTA — Diatype *Eudamus extrusus* Feld.
New name for ‡*Protogenes* M. and B.

VORATES — Orthotype *Cobalus decora* H.-S.
1900, Godman, Biol. Cent. Am., Rhop. ii, 577.

WALLENGRENIA — Orthotype *Hesperia premnas* Wlgr.
1897, Berg., Ann. Mus. Buenos Aires v, 254.

‡WATSONIA — Haplotype *Watsonia swinhœi* E. and E.
1897, Elwes and Edwards, Trans. Zool. Soc. Lond. xiv, 220. Preoccupied by *Watsonia* Fol., Mollusca, 1879. See *Stimula* De N. and *Watsoniella* Berg.

‡WATSONIA — Orthotype *Papilio metis* Linn.
1906, Tutt, Brit. Butt. i, 191. Preoccupied as above. A new name seems unnecessary.

WATSONIELLA — Diatype *Watsonia swinhœi* E. & E.
1898, Berg, Com. Mus. Buenos Aires i, 42, (Dec. 17). New name for ‡*Watsonia* E. & E. See also *Stimula*, which takes priority.

XENIADES — Orthotype *Papilio orchamus* Cram.
1900, Godman, Biol. Cent. Am., Rhop. ii, 518.

XENOPHANES — Orthotype *Papilio tryxus* Cram.
1895, Godman & Salvin, Biol. Cent. Am., Rhop. ii, 387.

XISPIA — Diatype *Praxis quadrata* Mab.
New name for ‡*Praxis* Mab., q. v.

YANGUNA — Orthotype *Pyrrhopyga spatiosa* Hew.
1893, Watson, Proc. Zoöl. Soc. London. 12.

ZAMPA — Orthotype *Zampa zenon* De N.
1895, De Niceville, Jn. Bomb. Nat. Hist. Soc. ix, 389.

ZARIASPES — Orthotype *Urbanus vigilans mys* Hbn.
1900, Godman, Biol. Cent. Am., Rhop. ii, 485.

ZEA — Orthotype *Pamphila mytheca* Hew.
1886, Distant, Rhop. Mal. 369.

ZELA — Orthotype *Zea zeus* De N.
1895, De Niceville, Jn. Bomb. Nat. Hist. Soc. ix, 386.

ZENIDA — Haplotype *Hesperia abdon* Plotz.
1904, Mabille, Gen. Ins. xvii, 159.

ZENIS — Orthotype *Hesperia minos* Latr.
1900, Godman, Biol. Cent. Am., Rhop. ii, 585.

ZESTUSA — Diatype *Plestia staudingeri* Mab.
New name for ‡*Plestia* Mab.

ZOGRAPHETUS — Orthotype *Isoteinon satwa* De N.
1893, Watson, Proc. Zool. Soc. Lond. 84. See *Scobura*.

ZOPHOPETES — Logotype *Pamphila dysmephila* Trim.
1904, Mabille, Gen. Ins. xvii, 183. *Dysmephila* and *natalica* Pl.
1905, Sharp, Zool. Rec. xli, 252. Cites *dysmephila* only. Does not say type.

ZOPYRION — Logotype *Zopyrion sandace* G. and S.
1896, Godman and Salvin, Biol. Cent. Am., Rhop. ii, 440. *Satyrina* Feld., and *sandace*.

NOTES ON SOME TYPES OF AMERICAN MUSCOID DIPTERA IN THE COLLECTION OF THE VIENNA NATURAL HISTORY MUSEUM

J. M. ALDRICH
United States National Museum

(Continued from Vol. XVII, p. 218)

27. *Viviania georgiæ* Brauer and Bergenstamm (1891, 312). The single type is a female, collected in Georgia by Morrison, March, 1877. The abdomen has been slightly damaged on one side, and several macrotype, flat eggs are extruded, one of which has become attached to the antennæ. In the National Museum are two females agreeing perfectly; one is labeled Washington, D. C., July 28, 1902, and has been placed in Pseudatractocera with a manuscript specific name by Townsend; the other was reared by J. J. Davis from an adult Lachnosterna taken at Woodville, Miss., and emerged May 29, 1918. Three males appear to be the same species; they were taken at Mesilla Park, N. M., by Cockerell, on June 15, 1898, and in June, 1899. The genus Pseudatractocera (type *neomexicana* Tns.) is probably distinct from Viviania, and should include *georgiæ*. Several North American species have been described, which are very difficult to separate, even from the types. Coquillett's identification of *georgiæ* (Revis. Tach., 1897, 82) was erroneous, although I think his species is clearly congeneric and the genus Eubiomyia Townsend (Insecutor Ins. Menst., IV, 1916, 74) based upon it is a synonym.

As the species is represented by authentic specimens in the National Museum, and belongs to such a difficult group, no attempt will be made here to determine the true diagnostic characters, which would require practically a revision of the genus.

28. *Masiphya brasiliana* Brauer and Bergenstamm (1891, 313). Described from a female taken by Natterer at Ypanema, Brazil. I have received from Vienna a female, evidently very ancient though well-preserved, bearing in neat script on a blue label, "N. c. Y." The specimen is labeled "Alsopsyche brasiliana BB type," but having bare eyes belongs to Masiphya, and I presume is the type of *brasiliana*. For Alsopsyche see next species. Accompanying this female is a male from Georgia labeled "Masiphya brasiliana BB.," one of several sent to Brauer and Bergenstamm by Dr. Riley many years ago; two males of the same lot were returned years ago labeled *brasiliana*. A study of our North American material leads me to the conclusion that we have in our Museum no specimens of the true *brasiliana*, and that the males from Georgia belong to a different species. All the females I have seen from North America have a distinct, curved piercer, while in the true *brasiliana* there is a blunt, black, rather prominent egg-

laying organ. In other respects the type agrees very well with the Georgia males, except that the front is decidedly golden, the face a little paler, and the abdomen shows no reddish ground color. The length is 10 mm.; the front by micrometer is .25 of headwidth; the second antennal joint is to the third as seven to sixteen; the height of the eye is to the bucca (below it) as 52 to 7; the length of the head at antenna is to that at the vibrissa as 33 to 28. Eyes bare. Palpi yellow, of about average length, but decidedly slender, with only small bristles at tip. Ocellar bristles minute, hardly distinct from the long, erect ocellar hairs; frontal stripe narrow, hardly half as wide as one parafrontal below, less than half above; frontal bristles 8, the upper two reclinate and strong, the rest smaller, the lowest at the middle of the second antennal joint; two stout orbitals standing close to the upper frontals, the lowest and largest of the latter is equally distant from the frontals of its side. Antennæ red except the upper and apical part of the third joint beginning at the arista and including all the tip. Thoracic chaetotaxy: acrostichal 3, 3; dorsocentral 3, 3; humeral 3-4; posthumeral 3 (one is far forward along the anterior edge); presutural 2 (inner as large as the posthumerals); notopleural 2; supra-alar 3; intra-alar 3; postalar 2 (one strikingly large); scutellum with 2 large and several small laterals, the apical pair large and decussate, no discals, the hairs of the disk erect and becoming a little spiny at tip; pteropleural 1 small; sternopleural 2, 1. Abdominal chaetotaxy: first segment with a good sized pair of median marginals, no lateral; second segment with one pair median marginal and one lateral; third with a marginal row of 8, all stout except the outer one; fourth with a row of 10-12 just beyond the middle, and a dense row of about the same at tip, continuing underneath with gradually smaller ones. The apical abdominal sternites beyond the third tergite are three, two of which are oblong, densely pollinose, hairy, the last one subshining black, heavily chitinized, with a transverse apical rim a little turned down and bearing hairs standing out laterally except near the middle. No indication of a chitinized piercer.

Legs black, heavily bristled, the front femora with heavy chalk-like white pollen on the hind side, beginning sharply at the row of bristles well above the middle line; front tibia with two spines on outer hind side; front side of middle tibia with three large bristles and one small between the lower two, the largest bristle is more than half as long as the tibia (in the proportion of 32 to 50); hind tibia with three successively longer bristles on the inner extensor side, a very irregular sparse row of about five on the outer extensor side (the largest one at the middle), and three successively larger on the outer flexor side. Wings hyaline, the fourth vein with a short, rounded curve into a slightly acute angle, thence with a concavity outward, ending well before apex, the first posterior cell rather wide open; third vein with eight setules at base. Our North American species erroneously determined heretofore as *Masiphya brasiliana* Brauer and Bergenstamm is a generally common one and it becomes necessary to give it a new name. Coquillet in his Revision, 1887, page 82, included *Tachinomyia floridensis* Townsend as a synonym of *brasiliana*. I examined the type of *floridensis* at the

University of Kansas in June, 1924, and found it to be a distinct species strictly congeneric with the genotype *Tachinomyia robusta* Townsend; the name therefore will not serve for the species here considered, which I therefore name

Masiphya confusa new species.

Length about 8 mm., considerably smaller than the Brazilian form. Most of the specimens considerably reddish on the abdomen. Width of front at narrowest in male type .26 of headwidth; in female allotype .31 of headwidth. The female differs from the above description only slightly except as to the genital characters. The ocellars are of good size. There are a pair of small discal scutellar bristles and the apicals are rather upturned. On the fourth abdominal segment the discal row is before the middle. The larvipositor or piercer is a prolongation of the last sternite. It is red, narrow, curved downward and sharp, a very distinct organ in a considerable hollow space in the tip of the abdomen in the dried specimen. The males are from eight to ten millimeters in length. They have on the third and fourth tergites below, on each side, a patch of minute, pale hairs, giving the effect of pollen, among which there are rather densely placed smallish black bristles; the whole effect of the spot is not very striking, much less so than in some sturmiine males and others. The genital segments are blackish to red, of small size; the inner forceps are brownish, narrow, tapering, close together to tip, straight; the outer forceps form large, triangular, shining red plates longer than the inner, the front and back edges almost straight, the front one with only a few hairs, tip with minute hook bent forward and outward. Penis with noticeably elongate basal portion so that the joint is some distance beyond the tips of the outer forceps; the apical portion is strongly flattened, thin basally in profile, divided deeply but narrowly into two lateral halves which are of soft structure and when not crumpled are tubular with an expanded rim. Only one pair of claspers can be made out in the preparations; they are slender and rather long and have a minute hook forward at extreme tip.

Described from 37 specimens of both sexes: 6 males and 5 females, including type and allotype, from Miami, Florida, (C. H. T. Townsend); one male, Biscayne Bay, Florida, (Mrs. A. T. Slosson); one female, Billy's Island, Okefenoke Swamp, Georgia; two males, "Ga." determined by Brauer and Bergenstamm; one pair, Falls Church, Va. (Banks, in the Walton donation); one male, Chevy Chase Lake, Md., (McAtee); one female, Rock Creek Park, D. C. (Townsend); one male, "Md."; one female, Dallas, Texas (Bishopp); five males and four females, Sabino Basin, Santa Catalina Mountains, Arizona, (Townsend); two males, Deer Creek Canyon, Peloncillo Mountains, Arizona (Townsend); two males, Pasadena, California (F. Grinnell); one male, Los Angeles County, California

(Coquillett); one male, Mount Lowe, California (Aldrich); one male, Cedar Pass, Black Hills, South Dakota (W. H. Over); and one male, Sierra Madre, Chihuahua (Townsend).

Type.—Male, Cat. No. 27564, U. S. N. M.

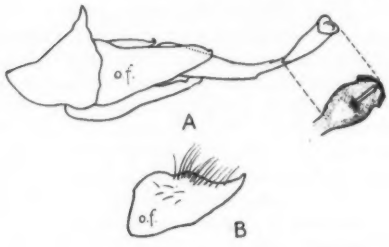


FIG. 1.

a. Genitalia of Masiphya confusa.
o. f., outer forceps.
b. Outer forceps of variety townsendi.

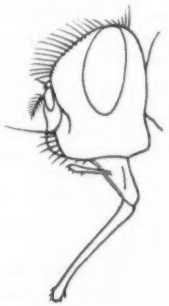


Fig. 2.
Head of Myiomima sarcophagina.

(Drawn by C. T. Greene)

Masiphya confusa townsendi, new variety.

I give this name to a form differing in the shape of the outer forceps; the organ is wider at base, convex and then concave on the front side and bears dense, erect hair near this edge as figured. I can see no other tangible characters.

Ten males from Sabino Basin, Santa Catalina Mountains, Arizona, August 17 to September 3; one male from Rio Aravaipa, Arizona. All collected by C. H. T. Townsend.

Type.—Male, Cat. No. 27565, U. S. N. M.

29. ***Alsopsyche nemoralis*** Brauer and Bergenstamm (1891, 313). One male, labeled "Lindig. 1864, Venez." and with the word Type on the specific label. The species is strikingly like the preceding, but has densely hairy eyes, as indicated by the describers. This certainly looks like a generic difference. The National Museum does not possess this species, which apparently is known only in this single specimen. Length, 9.4 mm. Head shaped about as in preceding. Front of male .25 of headwidth, without orbitals. More dense hair about the ocellars and no ocellar bristles. Frontals about 12, the upper two strong and reclinate, the rest smaller and close together, reaching about to the middle of second antennal joint. Proboscis short and fleshy, palpi yellow, of ordinary length, a little slender. First two antennal joints and extreme base of third red, the third about twice the second. Thoracic chaetotaxy: acrostichal 3, 3; dorsocentral 3, 3; humeral 4; posthumeral 2;

presutural 2; notopleural 2; supra-alar 3; intra-alar 3; postalar 2, one very large; scutellum with 2 lateral, the apical pair large and decussate, erect hair on disk but no discal bristles; sternopleural 1, 1; pteropleural 0. Abdomen: first segment with 1 pair median marginals far apart, and a small lateral; second with 1 pair median marginals and an indistinct row at the side; third with widely spaced row of 6; fourth with a row much beyond the middle and another at tip, of smaller bristles. Venter not with patches of small hair on the apical segments. Legs slender, mid tibia with 2-4 bristles, but only 1 large, hind tibia subciliate; claws and pulvilli all elongate, the latter brownish. Fourth vein rather sharply bent in a little more than a right angle, ending far before the apex; third vein with 6 hairs at base. The hairs of the abdomen are erect above, and the ground-color of the abdomen is largely reddish.

30. *Chrysotachina rheinwardtii* Wiedemann (Auss. Zweifl., II, 1830, 315, as Tachina). Type species of the genus Chrysotachina Brauer and Bergenstamm (1889, 161). 1 ♂, 1 ♀, "Brasilien," marked Type. Wiedemann evidently had several specimens, as he mentions some variations in the metallic color. The species is very closely allied to *alcedo* Loew, our commonest North American species; it agrees with this in chaetotaxy, having 3 posterior dorsocentrals and a large pteropleural. The third antennal joint, however, is distinctly narrower in the male (the antennæ are missing in the female type), and in the same sex the white hairs of the venter are much more extended than in *alcedo*, covering the under surface on the second and third tergites in a striking manner. In the female these are hardly perceptible, but the specimen is badly shriveled.

The National Museum possesses only a single specimen of *rheinwardtii*, a male from Rosario, Sinaloa, Mex.

31. *Tachina trivittata* Wiedemann (Auss. Zweifl., II, 1830, 300). One male, "Coll. Winthem," and "Amer. Insel." It has been referred to Nemorilla by Brauer and Bergenstamm, and in my opinion is *N. maculosa* Meigen, which is widespread in North America (see Aldrich and Webber, Proc. U. S. N. M., vol. 63, art. 17, 1924, p. 5). A male from Italy, identified by Professor Bezzi, agrees very well with this specimen.

32. *Prosopaea insularis* Brauer and Bergenstamm (1891, 334). One male, St. Thomas, West Indies, from the Winthem collection, and was apparently at one time labeled *Tachina insularis* by Wiedemann, but he did not publish the species. (Aldrich, Cat. N. A. Dipt., 1905, 463). Brauer and Bergenstamm attribute the species to Wiedemann; this is at any rate the type specimen. The genotype of Prosopaea is *instabilis* Rondani, of Europe, which has the first posterior cell closed in the margin, no ocellars, slightly developed discals on third segment, etc.

For the species *insularis* Brauer and Bergenstamm I propose the new genus PROSPALAEA. It has the excessively large bristles extending up the facial ridges of *Phorocera tachinomoides* and allies, but has bare eyes; other characters are given in the description below.

Male.—Front .25 of the headwidth. One pair large verticals, ordinary large divergent ocellars. Antennæ black, third joint red at extreme base, fully five times the second; second aristal segment little longer than thick. Facial ridges with stout, erect bristles not quite meeting the frontals, which just reach base of third antennal joint. Bucca one-eighth or one-ninth the eye height. Palpi normal, yellow. Proboscis ordinary. Thorax gray pollinose, indistinctly striped. Dorsocentral 3, 4; acrostichal 3, 2 (?); humeral 4; posthumeral 2; presutural 2; apical 3; intra-alar 3; postalar 2; scutellum with 3 marginal and a large apical pair (broken off, the last) also a discal; sternopleural 5 each side (4 in a row, one almost below the front one); pteropleural 0; third vein with 2-3; second and third abdominal segments without discals, the hair depressed. Abdomen gray with slight indistinct pollinose pattern; ground-color black; pollen same below as above. Genitalia small, brownish-black; the forceps slender, especially the inner, which are separate, almost needle-like. Mid tibia with two (one smaller) bristles, hind tibia subciliate, with one long in middle. Apical cell open well before apex, the bend rounded, no fold.

Length, 10.5 mm.

Not represented in the National Museum.

33. *Gaediopsis mexicana* Brauer and Bergenstamm (1891, 336). Type of the genus Gaediopsis Brauer and Bergenstamm. Two females; one is labeled "Bilimek. Mexico, 1871. Guadelupe," the other is the same except the last word, which is "Takubaya."

Female: Front very wide, measuring at the vertex .5 of the headwidth, still wider below. The pollen of the whole head in front and around the orbits is of a deep golden color, except a very striking brown band just below the lowest frontals, which crosses from eye to eye, except for the facial depression. There is also at about the middle of the front a brown spot on each side which extends back to the vertical bristles. The broad, median, frontal stripe is dark brown. Antennæ very slender, the third joint twice the second; penultimate joint of arista about four times as long as thick, but not geniculate with the following. Two large vertical bristles, one large ocellar pair, the usual two orbitals and about 9 frontals in the row, a supplementary outer row of from three to five, becoming smaller upward. The parafacials bear a somewhat regular row of stout hairs down the middle with irregular smaller ones. The facial ridges have a few long and somewhat irregular bristles extending up almost to the arista. The bucca is about one-third the eye height. The eyes are undoubtedly hairy, although not in very good condition to show this character. Palpi normal, yellow toward the base, brownish. Thorax with gray pollen and four rather distinct black stripes. The median gray stripe is wider than the one on each side of it. Acrostichal bristles 3, 3; dorsocentral 3, 4; humeral 4; posthumeral 2; presutural 2; supra-alar 3; intra-alar 3; scutellum with three pairs of marginals, a somewhat smaller pair of apicals and a discal pair of the same size as the latter; sternopleural 4; pteropleural 0. Abdomen gray pollinose without much pattern; the fourth segment with deep yellow pollen; first abdominal with a single pair of marginals; second

the same; third with a marginal row; fourth with irregular rows beginning at the middle. Legs black, all the tibiæ reddish; middle tibiæ with two to four bristles on outer front side. Hind tibiæ on outer side with only irregular bristles. Wings slightly brownish, third vein with two hairs at base; first posterior cell open before the apex. Length 7 mm.

The species is of the same size as *Chaetogaedia analis* Van der Wulp. It resembles it very much, but is even more closely related to *Gaediopsis ocellaris* Coquillett, from which it differs in very little except the presence of ocellar bristles, which in this case I think should not be considered of generic importance. It is apparently not represented in the National Museum.

34. *Paralispe brasiliana* Brauer and Bergenstamm (1891, 337). Type of the genus. Five specimens, but one labeled *brasiliana* from Brazil is *Myiopharus huascarayus* Townsend. The other four are the lot mentioned as all females by Brauer and Bergenstamm. All are labeled "Brasilien," and apparently collected at the same time. One of them is a male (with orbitals), the others females. Synonyms of this genus are Metadoria Brauer and Bergenstamm (1893, 208, type *mexicana* Brauer and Bergenstamm, equals *barbata* Bigot), Stomatolydella Townsend (Proc. U. S. N. M., 56, 570, 1919, type *infernalis* Townsend), and Austrolydella Townsend (ibid., p. 573, type *assimilis* Townsend). The species identified by Coquillett (Revis. Tach., 1897, 63) as *Didyma inconspicua* Van der Wulp is the same as *infernalis;* it may not be Van der Wulp's species, but is not rare in the United States; a long series was reared at Washington in 1924 from Lema trilineata by Doris H. Blake. It is not improbable that Paradoria Brauer and Bergenstamm will prove to belong to the same genus or come near it. The group is allied to Doryphorophaga and Myiopharus.

Male.—Front .27 of the headwidth. The parafrontals and parafacials with brownish pollen. Ocellar bristles absent; two pairs of verticals, the outer not very large; two orbitals on each side. Frontals about 9, the upper two reclinate, the second largest, the remainder smaller, the lowest one almost level with the tip of the second antennal joint. Facial ridges bristly almost up to the lowest frontal. Vibrissæ at the oral margin. Antennæ black, the third joint narrow, three times the second, reaching almost to the vibrissæ. Arista yellowish at base and slightly pubescent, its penultimate joint short. Bucca about one-sixth the eye height. Eyes distinctly hairy. Palpi rather dark yellow, brown at base. Proboscis very small. Thorax black with very indistinct stripes. Acrostichal 3, 3; dorsocentral 3, 3; humeral 3; posthumeral 3 (2 quite far forward); presutural 2; notopleural 2; supra-alar 3 (the first small, the second large); intra-alar 3; postalar 2; scutellum with 3 lateral, 1 upturned decussate apical and one small discal; sternopleural 2, 1; pteropleural minute. Abdomen shining black, the bases of the second and third segments with a slight silvery pollen, divided by a dark median stripe; first segment with one pair of median marginals; second with one pair each of discal and marginal; third with one pair discal and a row of 10 marginal; fourth with a few discal and very small apical. Legs black. All the claws and pulvilli

short. Middle tibia with one bristle on the outer front side; hind tibia on the outer hind side with about 16 nearly uniform small bristles. Wings with a distinct, yellowish-brown tinge along the costal part and following the veins. Fourth vein with a rounded oblique bend and thence almost straight to the margin; third vein with about 6 bristles at base.

Female.—Front .28 of the head width (average of 3, .27, .28, .30). Length of male, 7.5 mm., of female, 7 mm. Discal abdominals about half the size of the marginals on second and third segments. No piercer, the terminal organ being a compressed simple protuberance, rather distinctly visible. Middle coxæ without heavy, blunt recurved spines (they are present in female *assimilis*, absent in *infernalis*); both of these species have a distinct piercer in the female as in Doryphorophaga. No ocellars (they are present but small in *assimilis*, absent in *infernalis*, in both sexes).

By exchange one female type of *P. basiliana* is retained for the National Museum.

35. *Sardiocera valida* Brauer and Bergenstamm (1889, 119, type of genus). Two females, "S. Carolina," marked Type; a third female is from the Winthem collection, with a small pink square of paper for locality mark. It is the *Theresia tandrec* of Robineau-Desvoidy, without doubt, a species rather common in the Eastern States around Washington.

36. *Gonia rubens* Wiedemann (Auss. Zweifl., II, 1830, 343). One male, an ancient but well-preserved specimen, agreeing well with the description except that the red colors indicated have faded with the lapse of almost a century. It bears a very old label, "rubens W." in large letters, perhaps dating from Wiedemann. Wiedemann gave the locality as unknown, but this specimen now bears written labels "Type, S. America," and "rustiland Wd." It is from the Winthem collection. Wiedemann stated that his type was in the Vienna Museum. This specimen is probably not the type, but I would think it a contemporary specimen correctly labeled by Wiedemann. It is the other sex of the preceding, *Theresia tandrec* Robineau-Desvoidy (Myiodaires, 1830, 326). *Rubens* and *tandrec* were published in the same year, and I do not know which was earlier; there is no need to change nomenclature, especially as there is a slight element of doubt that this is the true *rubens*.

37. *Ptilodexia carolinensis* Brauer and Bergenstamm (1889, 119, type of genus). Two males marked Type, South Carolina. Readily matched with 5 males in the National Museum from Franconia, New Hampshire, and one from Hell Canyon, Manzano National Forest, New Mexico. The genus is the same as identified in the Museum, the specimens are among the darkest of what seems to be a single extremely variable species, but may on intensive study prove to be several. From the note by Austen in Annals and Magazine of Natural History, XIX, 344, I conclude that *Dexia harpasa* Walker (List, IV, 840) is an older name for this species.

Palpi, antennæ except apical half of third joint, and the tibiæ indistinctly, yellow; transverse impression of lower cheek broad, reddish, bare; parafacials wide, with scattered rather coarse dark hairs down to the impression; antennæ very small, the second joint wider than third, and more than half as long; facial carina very slight, imperceptible; proboscis beyond the hinge to the small labella slender, shining black, hardly longer than the first joint of the front tarsus and of the same diameter; frontals about 8, beginning somewhat below the ocelli and ending at the very beginning of the antennæ; ocellars large, proclinate; verticals represented only by hairs, all of which bend forward; front bulging, the narrowest place .103 of headwidth. Middle tibia with 3 on outer front and 2 on outer hind; hind tibia with an increasing row of 4 or 5 on antero-dorsal, ending a little beyond middle, and a similar row on postero-dorsal, which is mixed with a few rather even cilia. Hind basitarsus with a very distinct curved bristle below close to base. Abdomen with two pairs of slightly irregular discal bristles on each of the intermediate segments, ground color slightly reddish at the sides; with the naked eye there appears to be a median broad, oval, dark pollinose spot or stripe, disappearing or changing its shape in different lights. Length, 12 mm.

38. *Trichodura anceps* Fabricius (*Musca anceps* Fabricius, Syst. Antl., 1805, 296; *Dexia anceps* Wiedemann, Auss. Zweifl., II, 1830, 372; type of Trichodura, Macquart, Dipt. Exot., II, 3, 1843, 248 (sep. 91), pl. XI, f. 1; Brauer and Bergenstamm, 1889, 120). One male from the Winthem collection, labeled "Mer. Amer." and "anceps Wd. Br. Bgst. Type." It is apparently not the Fabrician specimen, but agrees well with Wiedemann's redescription and I think is correctly identified. Fabricius, Wiedemann and Macquart all reversed the sexes in this species attributing the long tail to the female. Townsend's *Trichoduropsis guianensis* (Proc. U. S. N. M., 56, 1919, 553) from Guiana, represented by two females, types in the National Museum, is almost certainly the female of this species. The male is much more elongated than the female, and the last abdominal segment is drawn out into a cylindrical process extending 6 millimeters beyond the genitalia, bearing a few erect, scattered bristles; this structure is about as in Uramyia. In both sexes the color is mostly yellow, with a deep brown stripe beginning on the anterior thoracic spiracle, passing above the root of the wing, and fading near the angle of the scutellum, leaving the humerus of contrasting light color. In the female the abdomen is brownish-red, and has on each side of the fourth segment at its base a striking velvet-black spot. In the male there is a shining black crossband in the same place, expanded laterally, and not velvety. The third segment in the male has near its base a large pair of discal bristles, wanting in the female; but as the abdominal segments of the male are greatly elongated, these discals may be merely an accompaniment of this specialization. The wings of the male are much longer and narrower than in the female, and are also more uniformly infuscated; in the female they are yellow to the middle, then suddenly brown. Length of male, 18 mm.; female only 9.

39. *Chaetogyne vexans* Wiedemann (Auss. Zweifl., II, 248, as Stomoxys; type of Chaetogyne Brauer and Bergenstamm, 1889, 125). Two males and a female, all from the Winthem collection and marked Type, as follows: (a) ♂, from "Brasilian, St. Paula." (b) ♂, from "Brasilien." (c) ♀ from "Brasilien."

(a) Has the proboscis broken off just beyond the joint; no median marginals on second abdominal segment.

(b) Has a short proboscis, and a row of 9 median marginals on second segment.

(c) Has the head partly eaten off, no proboscis remaining at all, but has 9-10 median marginals on second abdominal.

It is apparent that (a) is a different species from (b) and (c), and I feel sure that it is the real type. Wiedemann implies that his species has a conspicuous, long proboscis when he places it in Stomoxys, which would rule out the other species. Besides his locality was "Sct. Paul in Brasilien." Brauer and Bergenstamm did not mention the proboscis in 1889, 125; but in 1893, 175, they say, "Proboscis capite multo longior, setacea, labellis indistinctis, minimis." The organ must have been broken off later. I therefore confine my description to the first specimen. Neither species is represented in the National Museum.

Male.—Front .25 of the head width at narrowest, just before ocelli; bucca one-half the eye height. Frontals in single row stopping at antennal insertion, lunula prominent, shining yellow. The broad flat yellow carina narrows at upper end, where it is sulcate. Parafrontals, parafacials and bucca all with smooth, plumbeous, white pollen, more bluish above; parafacials bare, broad. One pair verticals. Ocellars large. In profile there is a notch at lower end of carina before the protuberance of epistoma. Antenna two-thirds as long as carina, red, third joint black from arista. The arista black, plumose. Palpi yellow, clavate, hardly of average size. Thorax dark gray, brown behind and on scutellum; bristles small and little developed on the discal portion. Only 1 posthumeral and 1 presutural; sternopleural 3; pteropleural 0. Calypter and base of wing brown. Abdomen broad, quite uniform brown with faint median dark stripe, and dark hind borders on segments two and three; no discals on any segment; no median marginal on one and two; a row (scars) of 14 on third. Smaller row (scars) on fourth. Genitalia small, brown, the intermediate segment distinct, first segment bare (a good character). Venter concolorous with dorsum. Hair of abdomen short, smooth. Pollen inconspicuous. Legs black, slender, not long; mid tibia with one bristle on outer front side. Hind tibia with cilia on outer hind side and one longer at lowest third, one on flexor side at same level. Wings slightly brown, deep brown at base. Apical cell open well before the tip, the fourth vein not appendiculate nor perceptibly swung backward at bend. Third vein with two small hairs at base. Apex of second vein almost at exact middle between first and third. Length, 14 mm. Abdomen over 6 mm. wide. (Wiedemann says 3 lines).

40. *Mochlosoma validum* Brauer and Bergenstamm, 1889, 127, pl. VIII, Fig. 2. Type of the genus. The name *validum* is attributed

to "Say *in litt.*" One male from the Winthem collection, locality "Pennsyl." printed label, and marked Type. Three other males from Mexico, labeled as types of *Mochlosoma validum*, are *Trochilodexia analis* G. T., as identified by Coquillett and accepted by Townsend in the National Museum collection. This is a distinct species but congeneric; as it is the genotype of Trochilodexia Townsend (Proc. Biol. Soc. Wash., XXVIII, 1915, 22, no description), this genus becomes a synonym of Mochlosoma. The original Say specimen is undoubtedly the one from Pennsylvania, and this should be regarded as the real type. It is on a short, thick pin with an enormous round head, and does not bear a Say label. The National Museum collection contains several specimens of the true *Mochlosoma validum* from Mound Valley, Chihuahua, Mexico, collected by Townsend on flowers of Rudbeckia, August 23 and 24, 1910; also a series taken by M. C. Lane at Bead Lake, Newport, Washington, August 9, 1922. None of these show any reddish ground color on the sides of the abdomen, but they agree in all other respects. The description of the type follows:

Male.—Front .11 of the headwidth, the frontal bristles forming a dense row beginning some distance below the ocelli and stopping just at the base of the antennæ. Frontal stripe red, parafrontals gray pollinose; parafacials slightly more yellow, with scattered coarse dark hairs, the transverse impression dark red. Bucca slightly more than half the eye height; ocellar bristles large, several pairs behind them but little smaller, all proclinate. Antennæ red, the third joint brown from the arista, short and small, only a little longer than second joint. Arista with erect plumosity. Face hardly wider than one parafacial, with a rather low but distinct carina. Vibrissæ considerably above the mouth, hardly more approximated than the facial ridges. Palpi yellow, cylindrical, just as long as the second joint of the front tarsus. Proboscis black, very slender, with almost no trace of labella, about one-half longer than the front tibia. Thorax black, slightly rubbed, very indistinctly striped. Prosternum bare. Abdomen reddish along the sides, with a dark median stripe tapering behind, its bristles numerous and erect, the second and third segments with two or three pairs of discal bristles beside erect bristly hairs; the fourth segment with numerous erect bristles and hairs. Genitalia small, fifth sternite with rather small lobes. Femora black, reddish toward apex, wholly dark red, tarsi black. Front tibia with three bristles on outer hind side, middle tibia with three bristles on outer front side; hind tibia with an erect row on the outer hind side, stopping at two-thirds the length. Wing slightly brownish, fourth vein curving backward beyond the hind crossvein so as to approach the margin, then broadly curved forward, convex to the costa, which it joins rather near the apex; third vein with three or four bristles at base. Length 12 mm.

This genus differs from the European Prosena (type *sibirita* Fab.), which has a broad, long, flat facial carina, long third antennal joint, very short and somewhat swollen palpi and no discal bristles. The American genus Prosenoides Brauer and Bergenstamm (1891, 370, type *papilio* Brauer and Bergenstamm of Brazil) is like Prosena except

with considerable longer palpi which are not swollen. It includes beside the type species *Prosena curvirostris* Bigot and *flavipes* Coquillett.

41. *Lasiopalpus flavitarsis* Macquart (Dipt. Exot., Suppl. II, p. 80 (sep. 64), pl. 3, fig. 1; Brauer and Bergenstamm, 1889, 131, fig. 228). Genotype of Lasiopalpus Macquart. One male and two females labeled "Lindig. 1864. Venezuela." In spite of the fact that the species was described by Macquart in 1843 from a single male of unknown locality, two of the specimens are plainly labeled as types, an obvious error as we understand the term, limiting it to specimens mentioned by the describer in the original publication. These Vienna specimens however agree with Macquart's description and I do not question the correctness of the determination; one of the females is the subject of Brauer's excellent figure. This is the only genus of Dejeaniini known to me which has greatly enlarged and heavily fringed palpi, hairy eyes, and bare parafacials. The palpi in Townsend's Eulasiopalpus are about the same, but it has bare eyes and hairy parafacials. From the scutellum back the bristles are very stout and spiny, and on the venter they occur in groups on the broad second, third and fourth sternites in both sexes, more than on the inflexed ends of the tergites. The genus is so easily recognizable as hardly to require detailed description. It was not represented in the National Museum, and I am permitted to retain one female of the Vienna lot.

42. *Myiomintho elata* Brauer and Bergenstamm (1889, 138). Two males, "Lindig. 1864. Venezuela." Marked type. Brauer and Bergenstamm based the genus and species on both sexes, neither having orbital bristles, the male differing from the supposed female by having a very narrow front. The specimens sent are evidently what they called the female, hence they confused two species. I restrict the species to the ones I have seen, described below.

Male.—Front .31 of the headwidth (the same in both), covered with rather lead-colored changeable pollen, becoming silvery on the parafacials. Ocellar bristles very minute; verticals 2, the outer not very large. Frontals about 8, the upper two decidedly reclinate, the second largest, the remainder decussate, diverging below and reaching almost to the arista. Parafacials bare, at narrowest hardly more than half the width of the third antennal joint. Arista bare, but little thickened at base, penultimate joint short. Vibrissæ at edge of mouth, not approximated, only three or four small bristles above them. Antennæ black, the third joint with parallel sides reaching almost to the vibrissæ, four times the second. Bucca one-fifth the eye height, broadly red below the eye. Palpi yellow, of ordinary size. Proboscis yellowish, short and fleshy. The front is somewhat brown at the antennæ. Eyes bare. Thorax black with somewhat satiny reflections, not striped, the suture in its lateral expansion somewhat silvery. Pleuræ black with thin whitish pollen. Chaetotaxy: acrostichals 3, 3; dorsocentrals 2, 3; humeral 2; posthumeral 1; presutural 1; notopleural 2; supraalar 3 (small except the middle one) intraalar 3; postalar 2; scutellum with one large and one small lateral, a large divergent apical pair and a small pair of discal; sternopleural 2; pteropleural minute; post scutellum

strongly developed. Abdomen wholly yellow except a faint brownish median stripe. First segment with one pair of median marginal, second segment with one pair median marginal and some recumbent bristly hairs each side laterally with two bristles; third segment with a marginal row of about 10 widely separated each side of the middle pair; fourth segment without discals, bearing only a marginal row of 6 or 8. Genitalia small and retracted, the last segment brownish; sternites except the basal entirely concealed. Legs black, all the claws and pulvilli small. Middle tibia with one bristle on the front side; hind tibia on outer side with 6 or 8 small bristles stopping at the middle. Wing distinctly infuscated throughout, more so along the costa beyond the auxiliary vein, extending back to include the second vein; fourth vein obliquely bent with a rounded curve slightly convex beyond and ending barely before the extreme tip; third vein with three or four small bristles at base. Calypters white. Length, 7 mm.

43. *Pseudoredtenbacheria brasiliensis* Schiner (Novara, 1868, 323; Brauer and Bergenstamm, 1889, 138). Schiner referred the species to the genus Redtenbacheria, of which the type is a European species. Type of Pseudoredtenbacheria.

Represented by one female labeled "Novara R. Brasilia." Has a small folded label, probably in Schiner's hand, "Redtenbacheria brasilensis Sch."; also labeled by Brauer and Bergenstamm as "Type." This is undoubtedly Schiner's type specimen. It is closely allied to *Chaetona longiseta* Van der Wulp as identified by Townsend in the National Museum, but the latter has a peculiar elongated arista, which bears erect short plumosity. It also has a more prominent front.

Female.—Front .26 of the headwidth, the dark brown median stripe sharply defined and of the same width as one parafrontal. The parafrontal with yellowish-gray pollen becoming silvery below, which extends down the parafacial. Vertical bristles, one large and one small; ocellars well developed, diverging forward; frontals about 8, the two upper reclinate, but the uppermost quite small, the lowest reaching the base of the third antennal joint but not diverging toward the eye very much. Two proclinate orbitals as usual, but standing very close to the frontal row. Antennæ red to the arista, black beyond; third joint long and slender, four times the second; arista long and slender, not thickened at base, pubescent about half way. Parafacial narrow, its lower part about one-half as wide as the third antennal joint. Vibrissæ at oral margin not approximated. Bucca one-sixth the eye height, reddish in color below the eye. Palpi yellow, normal; proboscis short. The whole head is rather flat, the front not protuberant and when viewed from in front is not very much wider than high. Thorax black, gray pollinose, with four narrow, indistinct black stripes. Acrostichal 1, 3; (the pair before the suture are large, well forward); dorsocentral 3, 3; humeral 2; posthumeral 2; presutural 1; notopleural 2; supraalar 3; intraalar 3; postalar 2; scutellum with two lateral, one long divergent apical (longer than the lateral), one rather small discal; sternopleural 2 (one hair-like below the anterior); pteropleural 0. Post-scutellum strikingly prominent, its tip directly below that of the scutellum. Abdomen with thin

gray pollen, more dense on the base of each segment, subshining on the remainder, with dark spots at the bases of the hairs. First segment without marginals, second with one pair discal and one pair marginal, third with one pair discal and a marginal row of 8, fourth segment with a discal row of 6 and a few apical. Legs reddish-yellow, including coxæ; the tarsi more brown; middle tibia with one bristle on outer front side; hind tibia with irregular bristles on outer front side. Wings slightly brownish with an ill defined, but noticeable infuscation on the apical half, most marked before the third vein. First posterior cell ends only a little before extreme apex. Length, 8.2 mm.

44. *Beskia cornuta* Brauer and Bergenstamm (1889, 139, fig. 276). Type of the genus. One male, two females. The male is labeled "Beske. 848. Brasilien." One female, undoubtedly the one figured, is labeled "Brasilia. Alte Sammlung." The other female is labeled "Steiglmayr. Rio Gr. do Sul." As the first specimen is the only one bearing the name of Beske, it must have been a type, and the second also, since the figure exactly matches it; the third specimen may not have been a type. Brauer and Bergenstamm were at a loss to distinguish the sexes, since the terminal segments of the abdomen in the female have a deceiving resemblance to those of a male; they do, however, have a small hairy tube standing out below, and the fifth sternite is not cleft as in the male. The third antennal joint is narrower and at apex less oblique than in the male. These types are so close to our northern *aelops* Walker, well known in collections, that the only question arising is whether they are all one species. After examining 20 other specimens, from British Guiana, Costa Rica, Mexico, Texas, Louisiana, Georgia, and Oklahoma, now in the National Museum, I have come to an affirmative conclusion, and hence would call them all *aelops*. In the Brazilian females the genital segments are shining black, while in those from the United States they are yellow; this proves to be a variable character. Discal bristles on the abdomen are also highly variable, and they are usually smaller than the marginals.

45. *Peteina stylata* Brauer and Bergenstamm (1891, 387). One female, "Greenland. Alte Sammlung." Undoubtedly the type. This, however, is not the genotype of Peteina, which is *Musca erinaceus* Fabricius, a European species. *Stylata* is a strongly marked species, represented in the National Museum by two Greenland specimens received from the Zoological Museum, Copenhagen. It has many points of resemblance to *Phorichaeta sequax* Williston, but the head is wholly different in form, the lower part projecting forward so greatly that it far surpasses the point of attachment of the antennæ; the bucca is equal in height to the small eye. A row of strong bristles extends down the parafacial; the two basal joints of the arista are elongate, the remainder bare; eyes bare; apical cell long petiolate, third vein with long hairs almost to crossvein. Without further detail it will be hard to mistake the species.

46. *Wulpia aperta* Brauer and Bergenstamm (1891, 128, 188). One female, labeled "Bilimek. Mexico. 1871. Orizaba. Novb." Is undoubt-

edly the type and so labeled. Genotype of Wulpia Brauer and Bergenstamm, loc. cit., a preoccupied name for which Townsend proposed to substitute Brauerimyia (Muscoid Flies, 1908, 65, Smithsonian Misc. Publications, No. 1803). The specimen is in rather poor condition as regards its pollinose covering; in almost every detail it agrees with *Vanderwulpia sequens* Townsend (Canadian Entomologist, XXIV, 1892, 172), except that it is undersized, being only 6 mm. long as compared with 7.2 to 8.5 for our series; the bristles are in consequence slightly less strong, though agreeing exactly otherwise. The thorax shows distinct indications of the two broad black stripes separating the three white pollinose ones. The arista is very short-plumose, not long-plumose, as stated by the describers, who evidently made a mistake here. The frontals stop one bristle short of the middle of the second antennal joint, but one of my *sequens* specimens has them the same; the bucca (below the eye) is, however, a little less than in any of the other series, about one-third the eye-height as compared with one-half, which looks suspicious. In the present condition of the type, in spite of the absence of any specimens matching it exactly in a few points, I can only pronounce it a small specimen of the species named *sequens* by Townsend. Townsend proposed the genus Catemophrys (loc. cit.) with *sequens* as type, just above Brauerimyia, which therefore takes page precedence over the latter.

47. *Leskiomima tenera* Wiedemann (*Stomoxys tenera*, Auss. Zweifl., II, 1830, p. 251). One female labeled with an elaborate capital F in script, no locality; also "Coll. Winthem" and "Type." Agrees with Wiedemann's description, and his specimen was a female without locality. This is the type of the genus Leskiomima Brauer and Bergenstamm (1891, 372). It was correctly identified in the National Museum by Brauer and Bergenstamm about 1895, returning specimens sent to them for the purpose. Coquillett placed it correctly in his Revision, 1897, p. 67, but in the National Museum collection he included a specimen or two with much longer palpi, belonging to Rondani's South American genus Genea.

48. *Microchira mexicana* Brauer and Bergenstamm. One female, labeled "Mexico. Alte Sammlung." Type of genus and species. Length, 9 mm.

A black species with rather heavy gray pollen, which has a yellowish tinge on head and abdomen.

Width of front at vertex .35 of headwidth; the front considerably protuberant at the antennæ; parafrontals and parafacials wide with golden yellow pollen, which extends around the eye, becoming narrow behind. Ocellars present but small (scars only); frontals only 6, the uppermost anterior to the front ocellus, apparently only one frontal turned back; one large pair of verticals and one smaller outside of them. The usual proclinate orbitals, lowest frontal quite a little beyond the middle of the second antennal joint. Parafacial wider than the length of the second antennal joint, bearing a row of small bristles numbering about 6, continuing above in a few small hairs. Also outside of these an irregular row of hairs extending down the middle. Antennæ black,

the third joint slender, two and a half times the second; the arista only a little longer than the joint, pubescent about to its middle, its basal joints short. Vibrissæ hardly above the oral margin, the ridges above them having only two or three small bristles. Palpi slender, but of ordinary length, dark yellow. Proboscis short. Bucca two-fifths the eye height. Thorax with somewhat glaucous pollen and four rather indistinct black stripes not coalescing in pairs. Acrostichal 2, 3; dorsocentral 3, 3; humeral 3; posthumeral 1; presutural 1; notopleural 2; supraalar 3; intraalar 2; postalar 2; scutellum with two lateral, one rather large apical and one small discal; sternopleural 3; pteropleural minute. Abdomen densely covered with pollen, which is decidedly yellowish, on the fourth, less so on the third; no median marginals on first segment, one pair on second, third with a row, fourth with a discal row and some smaller at apex. Legs black; middle tibia with one bristle on outer front side. Hind tibia with a very irregular row on outer side. Front tarsi slender, not compressed, the last joint tapering rather strongly in profile, with the claws and pulvilli very minute. Viewed from above the front tarsal joints show rather noticeable lateral hairs. Wings subhyaline, costal spine distinct; third vein with eight or ten hairs above, four or five below; fourth vein forming a right angle, which is slightly rounded, thence nearly straight to the margin, ending far before the apex; last section of fifth vein about two-fifths as long as the preceding.

Two females in the National Museum agreeing with the Types are from Atzcapotzalco, D. F., Mexico, Aug. 31, 1922 (E. G. Smyth).

From *Lachnommopsis armata* Townsend (genotype of Lachnommopsis), the nearest relative known to me, it differs in nothing material except that the latter has no hairs outside the parafacial row of bristles, the parafacials are narrower, and there is only one pair of posterior acrostichals. The front feet are about the same in the female, normal in the male. *Armata* was described only from males, but I found two females in the Townsend material from the same locality—Chosica, Peru.

Another near relative is *Phytoadmontia setigera* Townsend, which differs in having the row of bristles on the parafacials considerably stronger and no small hairs outside them, and the head flatter (shorter both at the antennæ and the epistoma). The front tarsi in *setigera* female are normal, as in the male.

49. *Argyromima mirabilis* Brauer and Bergenstamm, (1889, 139; 1893, 144).

One male (not female as given by Brauer and Bergenstamm), South America. Type of genus and species. A smallish, slender Tachinid resembling some of the Dolichopodidæ in its metallic blue-green color.

Length, 5.2 mm. Front .32 of the headwidth, two pairs of large, vertical bristles, the inner decussate; ocellar bristles absent; frontal bristles only about 6, the uppermost large and curving directly outward, the next two pairs a little smaller, decussate, the lower three pairs reclinate, reaching nearly to the tip of the second antennal joint. Frontal stripe blackish, sharply defined, wider than the parafrontal, which

is metallic greenish, becoming silvery below. Face and parafacials bright silvery, the latter apparently yellow in ground color, very narrow below. Antennæ black, third joint indistinctly paler at base, large and broad especially toward apex, with a rather square anterior angle, three times as long as second joint; arista moderately thickened at base, very slightly pubescent; penultimate joint short. Eyes rather protuberant, bare. The bucca one-fifth the eye height, with a dark brown stripe just below the eye, the back part silvery which extends up the orbit. Palpi yellow, normal; proboscis yellow, short, with large labella. Thorax subshining, green, with delicate pruinescence, the humeri and a short median stripe in front silvery. Pleuræ of the same color, a distinct round silvery spot in front of the anterior spiracle and a broad silvery stripe passing diagonally down across the mesopleura and sternopleura. Acrostichal 0, 0; dorsocentral 3, 2; humeral 2; posthumeral 1; notopleural 2 (small); presutural 1; supraalar 3; intraalar only one small; postalar 2; scutellum with two lateral (the posterior long) and a small decussate apical pair, no discal; sternopleural 2; pteropleural 0. Abdomen shining blue-green, with a silvery pollinose band on the basal half of the fourth segment; first abdominal segment with a large median marginal pair of bristles and some irregularly placed at the side; second segment with a median pair, which are apparently marginals, but are placed so far forward that they might almost be called discals, and with two large marginals on each side; third segment with one pair of discals and a row of 6 marginals; fourth segment with a discal row of 6 and a marginal row of 8. Genitalia small, reddish-brown in color. Legs yellow, including the coxæ. Bases of tibiæ all somewhat infuscated and a slight infuscation at the tips of all the femora; tarsi black; claws and pulvilli small. Middle tibia with two bristles on outer front side; hind tibia with two bristles on outer side. Wings subhyaline; fourth vein with very oblique bend, thence straight, the posterior cell rather widely open in the exact apex of the wing; third vein with two or three hairs at base, the last large and bristle-like, and one large hair below; hind crossvein straight, twice as long as the last section of the fifth vein; costa with a depressed spine.

50. *Leptoda gracilis* Wiedemann (*Dexia gracilis* Wiedemann; Leptoda Brauer and Bergenstamm, 1889, 125; 1893, 133). Four males, all from Mexico. One has a large label written in purple ink, "gracilis Br. Bgst. Type." One not so labeled is from "Coll. Winthem" and was probably identified by Wiedemann, if not his actual type. There is no reason to doubt that these are the true *gracilis*. The species is the same as *Dexia vertebrata* Say, which according to Coquillett, Type-Species, 1910, 621, is the genotype of Zelia Robineau-Desvoidy, 1830. Thus the genus Leptoda is a synonym of Zelia. Two unidentified females of the species, from Georgia and Texas, were included in the shipment for identification. They look quite unlike the males, and I believe it was the female of *vertebrata* which Van der Wulp described as *Melaleuca spectabilis* new genus and species, in Biologia, Dipt., ii, 247; Brauer and Bergenstamm, 1893, 183, suggested that Melaleuca might be a synonym of Leptoda.

51. *Myiomima sarcophagina* Brauer and Bergenstamm (1889, 119; 1891, 363; 1893, 175). One male, "Brasilia. Coll. Winthem," labeled type, no doubt correctly. Brauer and Bergenstamm gave only "America" as locality. Not in the National Museum.

Head, in profile, as shown in figure; the front is very prominent at the antennæ and vibrissæ, and the very high rather broad keel of the face shows beyond the third antennal joint. The parafrontals and parafacials are golden and also the region along the bucca below the transverse impression. The impression, however, is deep reddish-brown and very distinct in color. Palpi yellow, slightly brownish along the lower edge toward the base, of moderate size, only a little clavate. The lower part of the head projects backward more than usual. The parafacials are bare and uncommonly wide, being almost as wide as the width of the face in its middle part. The vibrissæ are considerably above the lower margin of the head. The proboscis beyond the joint is slender, shining, black, but not very much elongated. Thorax black, with four well-marked, broad, gray, pollinose stripes, the outer ones extending back from the humeri, the inner ones just inside the dorsocentral rows and extending slightly upon the scutellum. Chaetotaxy: dorsocentrals 4, 4; acrostichals 2, 3; humeral 4, 5; posthumeral 2; presutural 1; supraalar 4; intraalar 2; postalar 2 or 3; scutellum with two large lateral pairs, a large apical pair and a curved row of three or four pairs of rather small subdiscal; sternopleural 2, 1; pteropleural, a cluster of moderately stout bristles; post-scutellum prominent; calypters of good size, bare, the hind one darkened in the middle and the front one along its margin. Abdomen black, the tip of the fourth segment and the hypopygium yellowish-red. The gray pollen of the dorsum of the abdomen is somewhat changeable, but shows one or two median narrow stripes and a broader lateral one, which to the naked eye shows a rounded dark spot toward each side. The first segment without bristles except at the sides; second segment with a single marginal on the right side, no trace of one on the left. Third segment with a rather widely separated row of eight bristles; fourth segment with a row of about ten, which along the middle are some distance from the hind edge of the segment. Venter somewhat gray toward the middle which forms conspicuous spots on the second and third segments. Genitalia are not spread, but appear to be like those of Ptilodexia. Legs black, moderately elongated, but with claws and pulvilli short, the front ones being noticeably shorter than the others. Wings hyaline, the third vein with four hairs at base, hind crossvein somewhat S-shaped; bend of fourth vein subangular, a little oblique, without any appendage, the vein ending well before the apex, slightly beyond the tip of the third vein. The costal segment beyond the auxiliary vein is much longer than the one beyond the second vein. Length, 14 mm.

The nearest allied form in the National Museum is *Sturmiodexia rubescens* Townsend; it has a lower facial keel, cut off below by a transverse groove, and the head is less produced below and forward. The other characters agree generically, and the species are much alike in detail; *rubescens*, however, has long pulvilli.

52. *Tropidopsis pyrrhaspis* Wiedemann (*Tachina pyrrhaspis*, Auss. Zweifl., 307; Tropidopsis Brauer and Bergenstamm, 1889, 132; 1893, 147). One male, one female "Brasilia. Coll. Winthem." Undoubted types, and so labeled. Type of the genus. Not represented in the National Museum.

Front .14 of the headwidth. Eyes densely hairy; parafrontals with yellowish-gray pollen, the parafacials and buccal region of the same color. Antennæ yellow to about the arista, the remaining portion blackened, the second joint distinctly elongated, fully two-thirds as long as the third, which has a bulbous enlargement towards the tip; arista bare; parafacial at the narrowest fully as wide as the apical part of the third antennal joint. Face broad below, the vibrissæ far apart, about six bristles above them on the facial ridges, the uppermost at about the level of the middle of the third antennal joint. The bucca one-half the eyeheight, with two or three scattered bristles below the middle in addition to the row along the edge of the mouth. Palpi yellow, rather large, the tips somewhat broad and covered with coarse black hairs; proboscis short, fleshy, the labella light yellow. One pair of vertical bristles developed; ocellars normal; frontals hairlike above, about fifteen in the row, which extends to the middle of the second antennal joint and is partially double at the lower end. Thorax blackish, the scutellum, however, yellow and the front part of the pleura also yellow, including more or less of the humerus. Mesonotum with gray pollen on which four narrow black lines are somewhat distinct. Chaetotaxy: dorsocentrals 3, 4; acrostichals 3, 3; humeral 5; post-humeral 2; presutural 1; supraalar 3; intraalar 3 (one just behind the suture); postalar 2; sternopleural 2, 1; pteropleural 2, small; scutellum with about four pairs of spiny bristles around the margin beside a stout apical pair and also with several irregular pairs of upright spiny bristles on the disk. Post-scutellum well-developed. Hind calypters with a few distinct hairs above on outer hind part. Abdomen yellow, the fourth segment and a median posterior spot on the third black, without any distinct pollinose markings; first segment without bristles except laterally; second segment with a marginal row of four or five pairs separated from a lateral group of about the same number, also bearing a median pair close to the front edge and outside of these and a third farther back two more pairs; third segment with a marginal row of about seven pairs and a median, slightly curved row of four pairs not very far behind the front margin. Fourth segment with a row of about six pairs near the anterior margin, behind this with irregularly scattered bristles. Venter yellow, except the fourth segment; the second sternite with four stout black spines, third sternite with six and fourth with about ten somewhat smaller. Genitalia black, inconspicuous. Legs wholly yellow, middle tibiæ with two or three bristles on outer front side; hind tibiæ with only three or four bristles on outer side. Claws and pulvilli moderately elongated on all the feet. At the extreme bases of the second, third and fourth tarsal joints on the anterior side there is a rather striking, small, shining, black spot. Wings brown; third vein with five to six hairs at base; bend of fourth vein angulated and bearing a slight appendage.

Female: Front .21 of headwidth, with the usual two pairs of orbitals. Second abdominal segment with a discal row of seven spines, third segment with a discal row of ten; second sternite of abdomen with six spines, third with seven, fourth with about twelve. Black spots on the tarsi so minute as to be practically absent.

Length, of male, 14.2 mm.; of female, 14 mm.

53. *Leptoda thomæ* Wiedemann (*Dexia thomæ*, Auss. Zweifl., ii, 379. Leptoda Brauer and Bergenstamm 1891, 406). One male, "St. Thomas. Coll. Winthem." Undoubted type, but does not bear the word. It is a Zelia, and a different species from any in the National Museum. Wiedemann was apparently misled by the slender, sharp abdomen in calling the type a female.

Length, 9.5 mm. Gray pollinose, the apical half or more of the fourth abdominal segment red. On the second and third segments there are two discal pairs of bristles, one before the other, and on the third segment there is another discal on each side quite far from middle line of abdomen; the black posterior shining bands of the second and third segments are of nearly uniform width, not dilated into triangles except very faintly. The front (male) is rather broad, being .25 of the headwidth above by micrometer; it bears a row of hairs on each side of rather striking size, halfway between the frontals and the eye, near the vertex. The ocellar triangle is minute, and the lateral ocelli are vestigial, barely discernible under a power of 35 diameters. Sternopleural 2. Pulvilli short. The length of the legs is as follows in micrometer units, (total length of insect, 115 such units): Front legs—femur 34, tibia 30, tarsal joints 25, 15, 10, 5, 4. Total tarsus 59. Middle legs—femur 33, tibia 32, tarsal joints 20, 11, 7, 5, 4. Total tarsus 47. Hind legs—femur 32, tibia 30, tarsal joints 17, 10, 6, 4, 3. Total tarsus 40.

The nearest species in the National Museum is *tricolor* Coquillett (described as Metadexia, which I consider a synonym of Zelia). This has three sternopleurals and a more shining abdomen.

54. *Bibiomima handlirschi* Brauer and Bergenstamm (1889, 148; 1891, 443, fig.; 1893, 156). One male, "Bahia. Coll. Winthem." No doubt the type and so labeled. This is the specimen figured by Brauer and Bergenstamm, and apparently the only one known. Considering the striking appearance of the fly and the fact that it was collected a century ago, it is most remarkable that it has not been identified in later material. The figure by Brauer and Bergenstamm is excellent, making the species readily recognizable. All the veins are uniformly bordered with black, much as in *Plecia plagiata* Wiedemann, from Mexico. The genus belongs to the tribe Trichopodini, as indicated by Brauer and Bergenstamm.

55. *Reinwardtia tachinina* Brauer and Bergenstamm (1889, 158; 1893, 163). One female, "Lindig. 1864. Venezuela." Marked type. Type of the genus. A large metallic blue-green fly with a unique combination of characters, not closely related to any known genus, probably forming a distinct subfamily. Not represented in the National Museum.

Length 14 mm.

Head blackish, the parafacials and lower part of the parafrontals with smooth gray or somewhat lead-colored pollen, with indications of a changeable dark spot at the level of the antennal insertion.

Front .27 of the headwidth, the middle stripe broad so that the parafacials are very narrow above. Vertical bristles slightly damaged, one large pair, but the outer somewhat smaller; behind the ocellar triangle a widely divergent pair close together; ocellars normal, proclinate. Frontals ten to twelve in a rather even row, not very strong, ending at the lunule. No orbitals. No cruciate bristles. Antennæ inserted just above the middle of the eyes, black, third joint rather narrow, two and a half times the second. Arista long and thin, the basal joint short, the terminal joint a little thickened at base, where it has some pubescence composed of exceedingly fine hairs; these hairs also extend nearly half way to the apex, but are so delicate that they are scarcely visible except with a high power. Epistoma noticeably prominent, lower part of the face jutting forward between the vibrissæ, which are a little above the edge of the mouth; facial ridges with double row of stout hairs extending up to about the middle of the third antennal joint. Bucca one-fourth the eyeheight, bare except along the lower border. Palpi black, of good size; proboscis short and fleshy; eyes distinctly pilose. Thorax metallic blue with indications of white pollinose stripes on the anterior half, the bristles large. Thoracic chaetotaxy: dorsocentrals 2, 3; acrostichals 0, 1; humeral 2 large, 2 small; posthumeral 1; presutural 1; notopleural 2; supraalar 3 (the anterior more than half the second); intraalar 2 large; postalar 2; sternopleura 1, 2; pteropleura 0; hypopleura entirely bare except a few hairs on upper edge anterior to the spiracle; scutellum with five marginal pairs including the one at the apex which is of the same size without any discals. Postscutellum not developed. Calypteres blackish with still darker rim and fringe; they are not very large and the hind one has no perceptible hairs on the upper surface. Postalar declivity entirely bare. Abdomen broad, bright metallic-blue, without pollen; the first segment with only lateral bristles; the second with a complete row of spiny bristles on the margin, about twelve in all; the third segment with a row of twelve or fourteen just behind the middle and a marginal row of about the same number somewhat longer; fourth segment with a row just before the middle and some scattered on the remaining portion. The abdominal sternites are very broad and armed with dense spiny bristles, the exact arrangement of which is difficult to make out in the specimen. The terminal portion of the abdomen has been drawn out and shows a tubular, soft ovipositor ending in two chitinized points. Legs entirely black, the front tibiæ with a single bristle on front side at the middle; the front tarsi long with the last three joints distinctly flattened; middle tibiæ with one bristle on the outer front side and on the outer hind side at the middle, a second on the outer hind side not far from the tip; flexor bristle absent. Hind tibia with three bristles on the outer hind side near the middle, an oblique row at the apex of which the posterior two are considerably higher up. The hind basitarsus has no bristles on the under side.

Hind coxæ with numerous rather straight large spiny bristles directed backward. Pulvilli pale, yellowish, small but conspicuous. Claws not enlarged. Wing subhyaline or very little infuscated, some brownish clouds along the veins close to the base; stem vein bare, epaulet and subepaulet black; third vein entirely bare at base above and below; fourth vein broadly curved, slightly concave from thence to costa, ending distinctly before the tip of the wing; first posterior cell rather widely open. The costal segment beyond the auxiliary vein is but little longer than the one beyond the second vein.

The specimen is slightly teneral so that the bucca below the eyes is quite concave from shrinking. Probably in a mature specimen the color would be more green than blue. The absence of hypopleural bristles would exclude this fly from the Calliphoridæ and it will no doubt form a distinct subfamily, or at least tribe, as suggested by Brauer and Bergenstamm. The nearest known allies of this subfamily are probably Mesembrinini, of the subfamily Muscinæ, although even these are widely different.

56. *Masipoda geminata* Brauer and Bergenstamm (1889, 162; 1893, 123). Six males and six females, in three lots as to origin. One male and two females are labeled "Bilimek. Mexico. Orizaba," and are probably the types, although the word is not on the labels; four males and one female labeled "Mexico," and "geminata det. B. B.," and are probably later additions; one male is labeled "Brasilien," and could not be a type. The species is type of the genus. Giglio Tos, Ditt. del Mess., iii, 37, makes *geminata* a synonym of *rufilatera* Rondani 1850, described from Venezuela; he saw the Rondani type. *Exorista latimana* Van der Wulp he also makes a synonym of *rufilatera*, which is correct according to cotypes of the former received by the National Museum from the British Museum. This species belongs to the genus Winthemia, being clearly congeneric with *quadripustulata* Fabricius, the type species. The median and lateral pale pollinose stripes in *geminata* are heavy, and the intervening stripe along the dorsocentrals is very faint; so the thorax to the naked eye presents three very distinct white stripes, separated by two black ones.

Two of the females have a striking enlargement of the apical segment of the front tarsus (in the other female these tarsi are missing). The preapical segment is also wide, but very short, crescent-shaped. Van der Wulp gives approximately the shape of the front tarsus of the male in his figure of *latimana*, but the fourth segment is too long. He admitted the synonomy of *latimana* with *geminata* (Biolog. 2, 211). Both sexes have a single bristle on the outer front side of the mid tibia; sternopleural 1, 1; hairs of second and third abdominal segments depressed. The three females all have one pair of marginal bristles on the second segment; one male lacks these; two have one bristle only, the other one absent. Three males have one pair. All the males agree in having on the inflexed ends of the third tergite a large rounded patch of somewhat matted hair, continuing on the fourth tergite. One male and one female of the second lot are retained in exchange in the National Museum.

57. *Sturmia cubaecola* Jaennicke (*Tachina cubaecola*, Neue Exot. Dipt., 1867, 382, pl. 44, f. 6). One male, one female, one puparium (3 pins) all labeled "Cuba 277" in the same handwriting. The two flies marked Type no doubt correctly, as Brauer has recorded a note on the type. The same species was described as *Sturmia sociabilis* by C. T. Greene, Proc. Ent. Soc. Wash., 23, 1921, p. 125, figs.; his specimens were from Porto Rico, and have been compared with the Vienna types. The puparium accompanying the Vienna specimens agrees with those accompanying Greene's types, described and figured by Greene in Proc. U. S. Nat. Mus., vol. 60, 1922, art. 10, p. 11, pl. 1, fig. 1. The Vienna types are so moldy that I should have felt a slight doubt of the identity of *sociabilis* had not the very peculiar puparium been the same in both. Mr. Greene has compared the puparia and considers them to belong to the same species.

As to the true generic reference, Brauer and Bergenstamm referred *cubaecola* from the moldy types doubtfully to Hemimasicera in 1893, 209. Brauer repeated this reference without the doubt in Sitzber. Kais. Mus., cvi, 14; but here it was a mere incident to a discussion of a different species. *Cubaecola* has no ocellars, and Brauer and Bergenstamm include one such in Hemimasicera, but the genotype has them. I have not enough acquaintance with the European species to attempt any changes of genera there.

On comparing *cubaecola* with *Sturmia vanessæ*, type species of Sturmia, I see so much agreement that I do not wish to change Mr. Greene's generic reference.

58. *Argyrophylax albincisa* Wiedemann (*Tachina albincisa*, Auss. Zweifl., ii, 1830, 334; Brauer and Bergenstamm, 1889, 163; 1891, 343; 1893, 121). Two males "St. Thomas" from Winthem collection. A third male is larger, mentioned by Brauer and Bergenstamm, 1891, 334, from same locality, but evidently not seen in 1889 and hence not type. Wiedemann says the type is in his own collection, hence there is some confusion of labels or the two cited are not the actual types. There is little doubt that they were identified by Wiedemann at least, and they agree precisely with the specimens described and figured by Walton in Proc. Ent. Soc. Wash., xviii, 1916, 189.

The National Museum possesses ten specimens of both sexes, and has identified others for workers in Porto Rico. Some of ours were reared from *Nacoleia indicata* Fabricius in Porto Rico by T. H. Jones and also by G. N. Wolcott; from *Hymenia fascialis* Cramer in Virgin Islands by C. E. Wilson, and from *Pachyzancla pertusalis* Walker in Porto Rico by R. T. Cotton. Wolcott in Jour. Dept. Agric., Porto Rico, vii, 1923, 222, reports it reared also from *Zinckenia perspectalis* Fabricius, and *Mesoncondyla concordalis* Hubner.

The female is much more pollinose than the male, quite gray in general color; and the striking silvery parafrontals of the male become yellowish pollinose; the usual orbitals are present, and only the inner pair of verticals.

59. *Trichophora analis* Schiner (Novara, 330). One female labeled "analis Mcq. Type B. B." in purple ink, large label, also "Trichophora analis. Type. det. Brauer Bergenst." The locality label is "Lindig. 1864. Venezuela." I am not sure but this is too late to be a Schiner type; it is not Novara material. He says he began to work up the Novara material in 1864 (preface, p. vi). Agrees with Schiner except that the sides of the fourth abdominal segment are only brownish, not black. He had three and perhaps described a darker one. The blackish wings, red abdomen and striking snow-white calypters give just the effect of Townsend's South American *Corpulentosoma cornutum*. That however has numerous discals on second and third abdominal segments, while *analis* has only one pair each. The nearest I see in actual characters is *Parepalpodes rimacensis* Townsend. How many valid genera there may be along here I cannot decide, but it goes in Parepalpodes in the strict sense. Differs in having parafrontals black and subshining to the lowest frontal. Antennæ wholly black; abdomen not showing the broad black median stripe with narrower white pollinose one upon it. The front tarsi of the female are distinctly widened in both species. This is not a genotype.

From Macquart's description, supplemented by this specimen, it appears that Coquillett misunderstood Trichophora in his Revision, 1897, 137. It belongs to Epalpini, having discal bristles, bare parafacials and slender proboscis.

60. *Arthrochaeta demoticoides* Brauer and Bergenstamm (1889, 134; 1893, 137). Two males "Lindig. 1864. Venezuela." Both marked type. Type of genus.

Townsend redescribed the species as *Eurythiopsis ochracea* new genus and species (Ins. Ins. II, 1914, 30); his three types, including one female, have been compared with the two from Vienna. The only difference is that both the latter have a black median vitta on the third and fourth segments, while in the Townsend types it fades out partially on this part. The subepaulet is red like the epaulet in all the material.

The genus Arthrochaeta is hardly distinct from Jurinella, established by Brauer and Bergenstamm in the same paper, two pages before, in a different "family." Comparing the genotypes, they are very distinct in specific characters, but have little to separate them generically. *Demoticoides* has a dull red abdomen with median dull black stripe. The bristles are quite long and fairly slender all over. *Coeruleonigra*, genotype of Jurinella, has shining black abdomen and the bristles are a little more robust, but the arrangement is the same; its third antennal joint is much more convex on the front side in the male, but only a little so in the female. Both species have a rather long pteropleural bristle, hairy eyes, no ocellars.

ENTOMOLOGICAL SOCIETY OF AMERICA

PROCEEDINGS OF THE WASHINGTON MEETING

Nineteenth Annual Meeting.

First Session, Monday Afternoon, December 29, 1924.

The Entomological Society of America convened in the Armory of the Central High School and was called to order at 1:50 P. M. by President Charles W. Johnson. The following papers were presented:

1. Regarding the Effects of the Venom of Some Supposedly Poisonous Arthropods of the Canal Zone. (10 min.) (Lantern). W. J. BAERG, University of Arkansas.
2. Observations on the Early Larval Activities of *Nymphula maculalis* Clemens. (15 min.) (Lantern). PAUL S. WELCH, University of Michigan.
3. Metabolism during Embryonic Development of Eggs and Metamorphic Changes of Pupæ. (15 min.) (Lantern). DAVID E. FINK, Bureau of Entomology, Riverton, N. J.
4. The Reorganization of Muscles During Transformation in the Odonata. (By title). ARTHUR D. WHEDON, North Dakota Agricultural College.
5. Progress in Bibliographical Work on the Hemiptera. (10 min.) H. M. PARSHLEY, Smith College.
6. Studies on the Genitalia of Cercopidæ. (10 min.) (Lantern). KATHLEEN C. DOERING, University of Kansas.
7. Taxonomic Value of the Male Genitalia of Certain Fulgoridæ. (By title). Z. P. METCALF, North Carolina State College.
8. Wing-venation as a Factor in Separating Certain Allied Deltacephaloid Genera. (10 min.) (Lantern). DWIGHT M. DELONG, Ohio State University.
9. Preliminary Paper on the Venation of the Hind Wing of Heteroptera. (By title). SARA HOKE, Iowa State College.
10. The Folding of the Coleopterous Wing. (20 min.) (Lantern). WM. T. M. FORBES, Cornell University.

The President then appointed the following Committees:

Nominating Committee—R. C. OSBURN, C. R. CROSBY, A. F. SATTERTHWAIT.

Auditing Committee—J. S. HINE, C. T. GREENE, D. M. DELONG.

Resolutions Committee—F. E. LUTZ, C. H. KENNEDY, H. M. PARSHLEY.

To serve as a substitute for absent members of the Executive Committee—J. M. ALDRICH.

Second Session, Tuesday, December 30, 1924.
Annual Business Meeting.

The Society was called to order at 10:30 A. M., by President Johnson. The report of the Secretary was presented by C. L. Metcalf, as follows:

REPORT OF THE SECRETARY.

On May 5, 1924, the following seventeen persons, having been duly nominated and recommended, were elected members of the Society by mail ballot of the Executive Committee. (See June, 1925, Annals for addresses).

SHERMAN C. BISHOP
SAMUEL BLUM
CHARLES F. BYERS
MELVIN B. DUNN
CHARLES L. FLUKE
JOHN E. GRAF
ALBERT H. GREER
C. B. HARDENBURG
REGINALD G. HARRIS
ROBERT LATTIMORE
CHUNG LO LIU
M. C. MARSHALL
HUGH K. MUNRO
RALPH L. PARKER
D. C. PARMAN
R. E. SNODGRASS
R. O. WAHL

On October 14, 1924, the following eleven persons, duly nominated and recommended, were elected to membership by mail ballot of the Executive Committee:

WILLIAM BEEBE
SAMUEL EDSON CASSINO
RUSSELL DECOURSEY
JOHN CLIFFORD ELMORE
JOE RANDOLPH FURR
HORACE GLADNEY
CECIL HART
EDMUND R. P. JANVRIN
OTTO EMIL PLATH
PHILIP SPONG
JOSEPH WILCOX

Early in the year an invitation was extended to Dr. L. O. Howard to give the Annual Public Address of the Society at the Washington meeting, which was accepted. Mr. S. A. Rohwer kindly consented to act as local representative in making arrangements for the meetings.

The Executive Committee met at 4:30 P. M., December 29, in the home of Dr. J. M. Aldrich, with the following members present: Chas. W. Johnson, W. E. Britton, Arthur Gibson, J. M. Aldrich and C. L. Metcalf. The following new members were elected:

RAYMOND HILL BEAMER
MARTIN BOWE
K. F. CHAMBERLAIN
PAUL JONES CHAPMAN
GEORGE C. DECKER
LESLIE E. DILLS
LEO F. DUFFY
HARRY L. GUI
GILBERT J. HAENSSLER
SARA HOKE
WALTER SENEFF HOUGH
J. D. HUMPHREYS
E. H. INGERSOLL
R. JEANNEL
E. G. KELSHEIMER
GEORGE F. KNOWLTON
JOHN S. LACEY
ALICE PEARCE MACDOUGALL
CHARLES R. MCGEOCH
PAUL RUDBERT ORR
DONALD R. PARKER
PAUL X. PELTIER
THERESA M. ROBINSON
CHARLES F. ROSS
ROBERT F. SAZAMA
WALTER A. SCOTT
RALPH MARION SEELEY
PAUL ARMSTRONG TURNER
CHARLES E. WHITE
STANLEY D. WILCOX
LEWIS B. WOODRUFF

The following members died during the year:

A. A. DALGLISH
A. A. LOVETT
A. D. MACGILLIVRAY
R. C. TREHERNE
C. H. TURNER

The following resignations were presented and accepted and the memberships are thereby terminated:

A. I. Bourne
A. E. Cameron
Paul Dognin
Alfred Lutkin
F. H. Mosher
J. D. Tothill
James Troop
Bruce Tulloch

Thirty members whose dues are in arrears for more than two years and who have been duly notified, were dropped from membership.

Total membership December 28, 1923, (See Annals, xvii, p. 120)	673
Members lost by death	5
Members lost by resignation	8
Members dropped	30
Loss in membership during 1924	43
Balance	630
New members elected during 1924	59
Total present membership	689

On December 23, the membership was in the following condition in respect to the payment of dues. The comparison with the two preceding years is shown.

	1924	1923	1922
Members and Fellows paid two years in advance	1	0	2
Members and Fellows paid one year in advance	244	194	179
Members and Fellows paid for year just closed	327	332	327
Members and Fellows one year in arrears	59	47	28
Members and Fellows two years in arrears	4	15	22
Members and Fellows three years in arrears	3	0	1
Life Members	15	15	15
Honorary Fellows	5	5	5
New Members not yet paid	31	64	74
Totals	689	672	653

The Executive Committee recommended that the Society make a second grant of $50.00 from the Treasury to the support of the Zoological Record.

The special committee appointed at the Boston meeting to canvass the membership of the Society with a view to election to fellowship, made its final report to the Executive Committee. Acting upon this report, the Executive Committee elected the following members to Fellowship:

F. E. Blaisdell
Annette F. Braun
Thomas L. Casey
R. A. Cooley
E. T. Cresson, Jr.
R. W. Doane
H. A. Gossard
W. E. Hinds
W. C. O'Kane
F. L. Washburn
Clarence M. Weed

The Executive Committee nominated Dr. L. O. Howard, Chief of the Bureau of Entomology, as an Honorary Fellow.

The following were elected members of the Thomas Say Foundation committee: Nathan Banks, to succeed himself, and E. C. Van Dyke, to succeed A. D. MacGillivray, deceased. These terms to expire December 31, 1926.

The following persons were elected members of the Editorial Board, to succeed W. M. Wheeler, E. M. Walker, and F. C. Muir: W. A. Riley, Edith M. Patch, and Arthur Gibson, their terms to expire December 31, 1927.

Respectfully submitted,

C. L. Metcalf, *Secretary.*

On motion the report of the Secretary was accepted and the recommendation concerning the gift to the Zoological Record approved.

A ballot vote of the membership present resulted in the unanimous election of Dr. L. O. Howard as the fourteenth Honorary Fellow of the Society.

The report of the Treasurer was as follows:

REPORT OF THE TREASURER

Current Funds.

RECEIPTS.

Balance December, 1923. (See Annals, Vol. XVII, p. 122)	$1,202.11
From Annual Dues of Members	1,873.50
From Managing Editor of the Annals	601.14
From Interest on Bonds	35.29
Gained by exchange	.12
Checks refused by bank (to balance)	19.00
Gifts for Zoological Record (anonymous)	20.00
For Reprints	8.00
Total	$3,759.16

EXPENDITURES.

Annals for June, 1923, (XVI, 2), including reprints	$ 330.50
Annals for September, 1923, (XVI, 3), including reprints	358.75
Annals for December, 1923, (XVI, 4), including reprints	430.40
Annals for March, 1924, (XVII, 1), including reprints	447.52
Annals for June, 1924, (XVII, 2), including reprints	384.75
Annals for September, 1924, (XVII, 3), including reprints	467.50
Postage and Wrappers for Annals	25.22
Printing and Stationery	78.25
Stamps and Stamped Envelopes	32.00
Office Supplies	1.64
Clerical and Stenographic Help	113.03
Safety Deposit Box	2.00
Lost by Exchange	.47
Checks refused by Bank	22.00
Express	1.07
To Managing Editor for Reprints	8.00
Gift to Zoological Record, including fee	71.20
Refund of A. D. MacGillivray dues	3.00
Total	$2,777.30
Balance, cash on hand, First National Bank, Champaign, Illinois, December 29, 1924	981.86
	$3,759.16

Of this amount, $200 belongs to the permanent fund, leaving an amount available to meet our obligations of $781.86.

LIABILITIES.

The Society owes the publishers for the Annals only for the December, 1924, number, being in this respect far ahead of our usual status. One and two years ago we owed for three numbers of the Annals, three years ago for four, and four years ago for five numbers. In spite of the fact that we have paid this year for six numbers of our journal (averaging $100 a number more than in previous years) we still have a balance of $781.86.

PERMANENT FUNDS.

Our permanent funds remain exactly as at the last report, (see Annals, Vol. XVII, p. 122), no life memberships having been received during the year. The amount in the permanent fund is $950, of which $750 is secured by bonds as listed in my latest report, and $200 is carried in the current account.

The Society is clearly in a very thriving condition with the largest membership and the largest income in our history. The Treasurer would like to call to the attention of the membership the opportunity of Life Membership for $50.00. This amount is the same as it was formerly, when our annual dues were only $2.00.

Respectfully submitted,

C. L. METCALF, *Treasurer.*

On motion the report of the Treasurer was accepted and the financial matters involved referred to the Auditing Committee.

REPORT OF THE MANAGING EDITOR.

I am glad to report that increased income has made possible a larger volume for the current year and we may expect a still larger volume for the coming year. We have had some articles of exceptional merit and articles are already in hand to assure us a very creditable volume for 1925 and one which we believe will call for all funds available for publication.

The income and expenditures of this office may be summarized as follows:

RECEIPTS.

Subscription account	$483.86
Sales of back volumes and odd numbers	203.93
Reprints and contributions	347.35
	$955.14

DISBURSEMENTS.

Stenographic, clerical help and labor	$ 36.49
Postage, express, etc	54.94
Engraving	262.57
Remitted to Treasurer	601.14
	$955.14

Our foreign subscription list has been increased and the library subscriptions, which now may be counted as a continuous and permanent source of income, are in a very satisfactory condition. We have still a number of complete sets of back volumes and these have been carefully checked up during the year so we know definitely as to years in which there is the smallest available stock. It is assumed that the price of Volume XVII and succeeding volumes will be priced at $4.00 and it is certainly desirable that the price of the volumes in which there is a shortage should be advanced and it would seem good business policy to announce that all volumes will be put on a $4.00 basis within a year.

The financial assistance of authors and institutions in furnishing illustrations for a number of articles is thankfully acknowledged and I wish to express my obligation to Dr. Kennedy, who has not only looked after the accounts of the office and the care of the back numbers, but has assisted in the reading of papers, the arrangement of illustrations and the correction of proof.

Respectfully submitted,

HERBERT OSBORN, *Managing Editor.*

On motion the report of the Managing Editor was accepted subject to the approval of the Auditing Committee.

On motion it was voted the sense of the meeting that the price of all back volumes of the ANNALS should be raised to $4.00 a volume, beginning January 1, 1926.

In an informal report, the Editor of the Thomas Say Foundation announced that the second memoir, Needham and Claassen's Monograph of the Plecoptera was in press and should be ready for distribution in February.

The report of the Treasurer of the Thomas Say Foundation was as follows:

REPORT OF THE TREASURER OF THE THOMAS SAY FOUNDATION.

RECEIPTS FOR 1924.

Balance on hand January 1, 1924		$362.69
Sixteen subscribers at $3.00		48.00
Two subscribers at $2.70		5.40
Interest on bonds		12.75
Total Receipts, 1924		$428.84

EXPENDITURES FOR 1924.

Jan. 5.	Stamps for mimeograph letters	$ 2.00
June 4.	Express on Needham and Claassen Manuscript from Washington to Lafayette	6.12
Sept. 19.	Express on manuscript from Washington, D. C.	.52
Oct. 27.	Stamps for J. M. Aldrich	1.00
Oct. 27.	Stamps for J. J. Davis	2.00
	Postage on 18 copies of Sarcophaga and Allies	3.78
	Total Expenditures	$ 15.42
	Cash on hand to balance	413.42
		$428.84

There are outstanding obligations to the original subscribers of $260.00, leaving a net balance of $153.42 to the credit of Volume 1.

Respectfully submitted,

J. J. DAVIS, *Treasurer.*

Examined and found correct, December 30, 1924.

JAMES S. HINE,
D. M. DELONG,
CHAS. T. GREENE.

On motion the report of the Treasurer of the Thomas Say Foundation was accepted and the financial matters referred to the Auditing Committee. Permission was granted to defer the report of the Committee on Resolutions until the Wednesday afternoon session. The report of the Auditing Committee follows:

REPORT OF THE AUDITING COMMITTEE.

The Auditing Committee has examined the books and accounts of the Treasurer of the Entomological Society of America, of the Managing Editor of the Annals and of the Treasurer of the Thomas Say Foundation. The Committee has found all of these accounts to be correctly kept.

(Signed) JAS. S. HINE,
CHAS. T. GREENE.

The report of the Nominating Committee was as follows:

REPORT OF THE NOMINATING COMMITTEE.

We, the undersigned members of the Committee on Nominations, beg leave to report the following names as nominees for the respective offices for the year 1925:

For President—GEORGE A. DEAN.
For First Vice-President—LAWSON CAESAR.
For Second Vice-President—P. S. WELCH.
For Secretary-Treasurer—C. L. METCALF.
For Additional Members of the Executive Committee—
Term expiring December 31, 1925: E. P. FELT, G. W. HERRICK.
Term expiring December 31, 1926: E. C. VAN DYKE, J. A. G. REHN.
Term expiring December 31, 1927: F. E. LUTZ, EDITH M. PATCH.
For Councillors to the American Association for the Advancement of Science—
W. A. RILEY, W. E. BRITTON.

(Signed) RAYMOND C. OSBURN,
A. F. SATTERTHWAIT.

On account of the matter involved, the proposed amendment to the constitution was next considered. On motion the following amendments were passed:

ARTICLE IV, SECTION 2. *Executive Committee.*—The business of the Society not otherwise provided for shall be in the hands of an Executive Committee consisting of the officers named in Section 1, the Managing Editor of the Annals, *ex officio*, and six additional members elected from the Fellows of the Society. There shall be a meeting of the Executive Committee at each annual meeting. Five members shall constitute a quorum and in the case of the non-attendance of this number at any annual meeting, the Society shall elect a sufficient number from among the Fellows in attendance to complete the quorum.

ARTICLE V, SECTION 5. *Election of Executive Committee.*—The elective members of the Executive Committee shall be selected by ballot at the annual meeting and shall each hold office for three years, two retiring each year. They shall, however, be eligible for re-election.

On motion, the Secretary was instructed to cast the unanimous ballot of the Society for the officers nominated. This being done they were declared duly elected.

An informal report was next made by A. N. Caudell, a delegate to the meetings of the Union of Biological Societies, urging official and individual support of the proposed Biological Abstracts.

The following report of progress was made by the Chairman of the Committee on General Entomological Terms:

REPORT OF COMMITTEE ON GENERAL ENTOMOLOGICAL TERMS.

Owing to unforseen circumstances, your Committee was unable to act until the beginning of November of the present year. Since then, however, many matters have been under discussion. An initial list of terms for the consideration of the Committee was prepared by the chairman and distributed to the members and to this was added a second list by Dr. Crampton, which was likewise distributed. Other suggestions for consideration have been received as a result of the publication in certain of the entomological journals (Ent. News, Journ. Econ. Ent., Can. Ent.) and in the preliminary announcement of the present meetings, of a notice drawn up by the Secretary of the Society and setting forth the objects of the Committee. These suggestions have also been communicated to the members.

The members of the Committee have all expressed their views on the questions brought up in connection with the first two lists of terms, but some of these have only just been received. With these exceptions the opinions expressed by each member have been communicated to the other members, but further discussion of these opinions will be necessary before any final decisions are reached.

Apart from specific terms, the most important matters before the Committee are the following:

(1) Should the rule of priority be applied to morphological nomenclature, or shall suitability displace priority if a later name is more suitable than an earlier one?

(2) To what extent should morphological significance of structure be considered in the terminology employed by systematists? In many cases there appears to be too little agreement among morphologists to warrant changes in the terms used by systematists. Should such terms as "pygidium," which have been in constant use by specialists in different orders for different structures be restricted or not? The structures are often obviously not homologous, yet it is doubtful whether anything would be gained by restricting the use of many such terms and giving new names to structures long known under the old ones.

(3) A satisfactory nomenclature for the different types of metamorphosis and immature stages is desirable; too many terms being in use at the present time. Use of such terms as larva, nymph, naiad, etc., should be clearly defined.

All of which is respectfully submitted.

E. M. WALKER, *Chairman.*

On motion the report was ordered accepted and filed.

The report of a special committee appointed at the Cincinnati meeting to consider the proposal to purchase the Barnes Collection of Lepidoptera for the United States National Museum, is as follows:

REPORT OF COMMITTEE ON CONTEMPLATED PURCHASE OF WILLIAM BARNES COLLECTION OF LEPIDOPTERA FOR THE UNITED STATES NATIONAL MUSEUM.

Two members of the committee discussed the matter at Cincinnati and, after prolonged correspondence with the members and the chairman of the similar committee appointed by the American Association of Economic Entomologists, Prof. J. J. Davis, the following matter comprised the body of a letter addressed to each of the officials named in the resolution and duly signed by the members of the committee:

"The contemplated purchase of the William Barnes collection of Lepidoptera for the United States National Museum has been repeatedly brought to the attention of entomologists of this country. The following is a transcript of a resolution passed at the request of a representative of the Secretary of Agriculture at the last annual meeting of the Entomological Society of America, held at Cincinnati, Ohio, December 27–29, 1923.

"WHEREAS, The sale of the William Barnes collection of Lepidoptera to the Government for the benefit of the United States National Museum is being carefully promoted, and

"WHEREAS, The interests of Entomology at large as involved in governmental support seem to demand competent and disinterested consideration, therefore, be it

"*Resolved*, That a committee of three be appointed by the president to consider measures proposed, and to report its findings at an early date to the Secretary of Agriculture, to the Secretary of the Smithsonian Institution, and to the Chief of the Bureau of Entomology."

The undersigned, duly appointed by the president of the society in accordance with the terms of the resolution, hereby submit their findings.

There is a general feeling among entomologists, fully shared by the committee, that the William Barnes collection of Lepidoptera should become a part of the collections of one of the larger institutions in this country, preferably the United States National Museum. It would be a most serious loss if it were disposed of in some other country. Incidentally we would go on record in favor of making the insect collections at Washington second to none in all groups, since large collections are essential to the early and correct identification of injurious insects, a matter of basic importance in economic or control work.

From information available, it does not appear that three hundred thousand dollars, the sum indicated in the bill introduced by Representative Moore, is excessive, so far as intristic value is concerned. It most certainly could not be duplicated for a considerably larger amount. The William Barnes collection of Lepidoptera has been characterized by an authority as by far the largest and most valuable collection of North American Lepidoptera in existence.

The committee would point out that the amount the National Museum would be justified in expending for the acquisition of this collection can be determined only after a careful examination by disinterested experts in order to determine the extent to which the National collections would be enriched by this addition, especially the number of types, cotypes, genera and species at present inadequately represented at Washington.

The committee has been unable to make such an examination. It could arrange to have this done, if it appears desirable, if one of the government agencies interested would meet the necessary expenses.

Respectfully submitted,

(Signed) E. P. FELT,
C. H. KENNEDY,
PAUL S. WELCH.

On motion this report was accepted.

Third Session, Tuesday Afternoon, December 30, 1924.

This, a joint session with the Ecological Society of America, was called to order at 1:50 P. M. by Charles W. Johnson, the President of the Entomological Society, who presided throughout the session. The following program was presented:

11. The Log as an Ecological Unit. (15 min.) S. A. GRAHAM, University of Minnesota.
12. Studies on the Ecology of Sand Dune Insects. (15 min.) (Lantern). ROYAL N. CHAPMAN, C. E. MICKEL, J. R. PARKER, G. E. MILLER, University of Minnesota, and E. G. KELLY, Kansas State Agricultural College.
13. The Significance of Insect Sounds. (15 min.) FRANK E. LUTZ, American Museum of Natural History.
14. The Relations of an Autumnal Dragonfly to Temperature. (15 min.) (Lantern). PHILIP P. CALVERT, University of Pennsylvania.
15. Insect Freezing Temperatures in Relation to Environmental Temperatures. (15 min.) (Lantern). NELLIE M. PAYNE, University of Minnesota.
16. Some Weather Relations of the Pale Western Cutworm. (15 min.) W. C. COOK, University of Montana.
17. Factors in Hibernation in *Leptinotarsa decemlineata*. (15 min.) (Lantern). DAVID E. FINK, Bureau of Entomology, Riverton, N. J.
18. A Bionomical Study of the Mosquitoes of New Orleans and Southwestern Louisiana. (15 min.) PERCY VIOSCA, JR., New Orleans Board of Health.
19. The Effect of Salt Concentration and Reaction on the Development of *Anopheles* Larvæ. (By title). By I. J. KLIGER and O. THEODORE, New York City.

Fourth Session, Wednesday Morning, December 31, 1924.

The Society was called to order at 10:30 and the following papers were presented:

20. Notes on Rearings of Texas Gall Insects. (10 min.) (Lantern). REGINALD H. PAINTER, Ohio State University.
21. Notes on Some Little-Known Thrips (Thysanoptera). (By title). GLENN W. HERRICK, Cornell University.
22. The Neuroptera and Mecoptera of Kansas. (By title). ROGER C. SMITH, Kansas State Agricultural College.
23. A Review of the North American Simuliidæ. (10 min.) RAYMOND C. SHANNON, United States National Museum.
24. Dipterological Observations in South Dakota. (10 min.) (Lantern). F. M. HULL, Ohio State University.
25. Contributions to the Classification of the Bremidæ, or Bumblebees, of Central and South America. (10 min.) (Lantern). THEODORE H. FRISON, Illinois State Natural History Survey.
26. The Genus *Jassus* in America North of Mexico. (10 min.) (Lantern). PAUL B. LAWSON, University of Kansas.
27. Some Taxonomic Studies of Aquatic Hemiptera. (By title). H. B. HUNGERFORD, University of Kansas.
28. Biological Notes on Several Species of the Family Tachinidæ. (By title). H. W. ALLEN, Mississippi Agricultural and Mechanical College.
29. Origin of Castes in Termites. (15 min.) THOS. E. SNYDER, United States Bureau of Entomology.

Fifth Session, Wednesday Afternoon, December 31, 1924.

The last general session convened at 1:45 P. M., when the following papers were presented:

30. An Outbreak of *Autographa biloba* Steph. on Greenhouse Lettuce. (10 min.) (Lantern). J. A. MANTER, Storrs Agricultural Experiment Station.
31. The Oviposition of Some Cicadas. (15 min.) (Lantern). RAYMOND H. BEAMER, University of Kansas.
32. Studies on the Eggs of the Reduviidæ. (15 min.) (Lantern). PHILIP A. READIO, University of Kansas.
33. The Oviposition Response of Insects. (15 min.) CHARLES H. RICHARDSON, United States Bureau of Entomology.
34. Notes on the Function of Certain Parts of the Palpus of the Erigoneæ. (15 min.) (Lantern). C. R. CROSBY, Cornell University and S. C. BISHOP, New York State Museum.
35. Characters of Family and Super-family Significance in the Male Genitalia of Microlepidoptera. (10 min.) (Lantern). JOHN R. EYER, North East, Pennsylvania.
36. The Anatomy of the Genitalia of the Muscoid Flies as Exemplified in *Hylemyia cilicrura* Rond. (15 min.) (Lantern). H. C. HUCKETT, Agricultural Experiment Station, Geneva, N. Y.
37. A Parasite of a Tortoise Beetle. (5 min.) (Lantern). WILLIAM COLCORD WOODS, Kent School, Kent, Connecticut.

The postponed report of the Committee on Resolutions was presented at this time.

REPORT OF THE COMMITTEE ON RESOLUTIONS.

1. In the death of Dr. Alexander Dyar MacGillivray the Entomological Society of America has lost a charter member, a Fellow, a devoted and efficient former secretary, and an entomologist, distinguished especially for his work on the external morphology of insects, the identification of immature insects and the classification of scale insects and saw-flies.

Therefore, be it resolved, that the Entomological Society of America express its high regard for Doctor MacGillivray's personality, his services to the Society and his ability as a scientist.

2. It is always a pleasure for an entomologist, even as an individual, to visit Washington. It is an even greater pleasure to meet as a Society in that city which has the proud distinction of claiming the residence of more entomologists than any other.

The Entomological Society of America thanks the Washington Entomologists in general and Mr. S. A. Rohwer in particular, for its very cordial reception and for the painstaking arrangements made for its 1924 meetings.

(Signed) FRANK E. LUTZ,
C. H. KENNEDY,
H. M. PARSHLEY.

Sixth Session, Wednesday Evening, December 31, 1924.

The closing session of the 1924 meetings was called to order at 8:00 P. M. by C. W. Johnson, in the Assembly Hall of the Cosmos Club. President Johnson introduced our newly elected Honorary Fellow, Dr. L. O. Howard, who delivered the annual address of the Society on the subject, "The Needs of the World as to Entomology," to an enthusiastic audience that filled the hall to overflowing. At the close of the address the visiting entomologists were delightfully entertained at a smoker tendered them by the Entomological Society of Washington.

Exhibits.

The following exhibits were among the splendid ones arranged by the members of both entomological societies and by the entomologists of Washington in particular, and were open for examination throughout the entire week:

(a) Two Interesting Live Arachnids—the California Tarantula, *Eurypelma californicum* and the Adult of the Common North America Chigger, *Trombicula irritans*, by H. E. EWING, U. S. National Museum.

(b) Drawings of the Genus *Jassus* (Cicadellidæ), by PAUL B. LAWSON, University of Kansas.

(c) A Parasite of a Tortoise Beetle, by WILLIAM COLCORD WOODS, Kent School, Kent, Connecticut.

(d) The Cicadas of Kansas and their Oviposition, by RAYMOND H. BEAMER, University of Kansas.

(e) An Improved Beating Net, by E. A. HARTLEY, College of Forestry, Syracuse, New York.

ORDER NOW!

The second monograph published by the Say Foundadation will be ready to mail about April 1. This is the "Plecoptera or Stone Flies of North America," by J. G. Needham and P. W. Claassen. It is a volume of 400 pages and 50 plates, in cloth binding. It may be had from J. J. Davis, Lafayette, Indiana, at $5.00.